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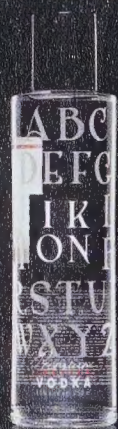
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Cover photo: New labeler at Hess Collection (Napa, CA). Photo by Don Neel.

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NEW EQUIPMENT: Greater efficiency, lowered costs

BY Don Neel

Hess Collection Winery (Napa, CA), is using new tools to improve bottling efficiency and increase its bottom line.

The bottling line includes an MBF fillblock with a maximum speed of 200 bottles per minute (bpm) that has been operating at 180 bpm for red wine and 195 bpm for white wine since installation in 2003. The fillblock has a 28-position bottle blower, a 55-valve low-vacuum filler, and a 9-head corker.

The valves on the filler inject nitrogen into the bottles prior to filling. Scott Shirley, associate winemaker, reports an acceptable O_2 pickup of 0.14 ppm, on average.

A Garvey Infinity accumulation table was inserted into the bottling line after the capsule dispenser/applicator, ahead of the new labeler in February,



Exact label registration by the C&G labeler is achieved by the movement of each bottle pedestal that is precisely controlled mechanically. Horizontal and vertical variation bottle to bottle is less than 2 mm.



This Garvey Infinity Accumulator has the capacity to hold 446 750 ml bottles or 223 1.5 L bottles, providing more than two minutes of pressure-less accumulation.

2009. When malfunctions occur downstream, the Infinity accumulation table extends an automatic gate and begins accumulating bottles from upstream equipment. Once the malfunction is fixed, the automatic gate retracts and the accumulated bottles flow out of the table in single file without back-pressure. This new equipment has helped increase bottling line efficiency 5% to 10% depending on package configuration.

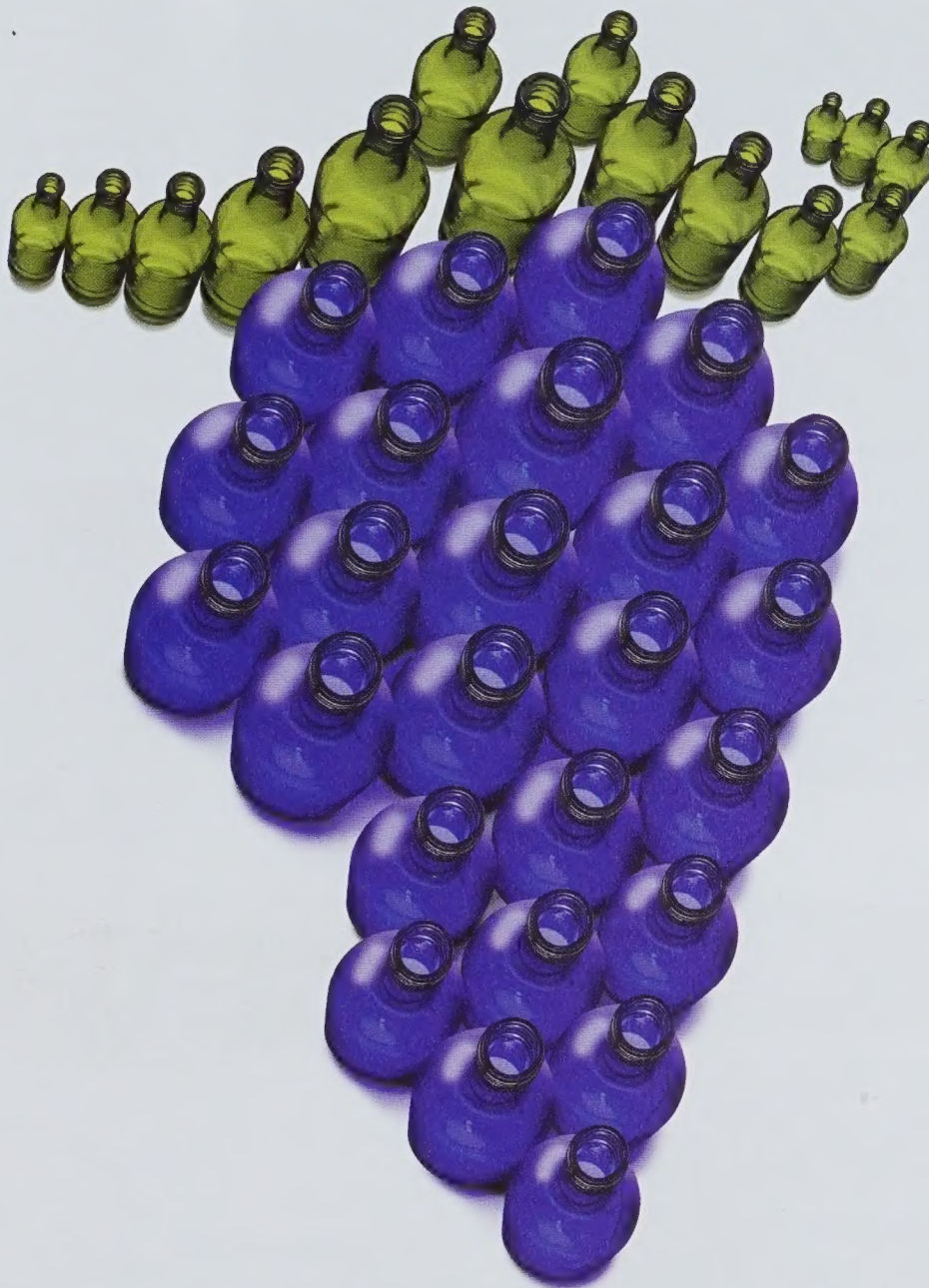
"The payback period for the accumulator, based on increased line efficiency, is projected to be 2.5 years," notes John Bulleri, Hess Collection Winery director of operations.

In February 2009, a Cavagnino & Gatti (C&G) combination wet glue and pressure-sensitive medallion labeling machine was installed. The labeler will save \$150,000 per year due to the lower cost of sheet-fed label production compared to pressure-sensitive (p-s) labels used on the previous labeler.

The new labeler can apply wet-glue face and/or back labels and a p-s shoulder label at a maximum speed of 225 bpm. The new C&G labeler and Garvey accumulation table were sold and installed by ColloPack Solutions, Napa, CA.

Paper label stocks used for Hess Collection different wines, including

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Completely enclosed and illuminated MBF fillblock has universal transfer screws, dust control for bottle-blower and corks, and automated lubrication and speed control. Productivity is enhanced with rapid assembly/disassembly of cork compression units, and the ability to adjust fill points and cork insertion during machine operation. Scott Labs is the North America agent for MBF bottling equipment manufactured in Italy.

60-lb estate #4, 60-lb Classic Crest, 70lb. Fasson Eggshell Felt, and 60lb. Classic Laid, are applied on Owens-Brockway bottles distributed by California Glass Company (Oakland, CA). Surface treatment for the bottles is a polymer coating that works well with cold glue and p-s labels. The synthetic glue has a fast set speed and high tack that adheres to "untreated" poly-coated glass and is "ice proof."

"We feel that glue labels have a greater crispness and depth of emboss-



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ing and greater color saturation than the same pressure-sensitive label," explains Beth Damron, procurement manager.

"Like everyone else today, we are concerned about our overall carbon footprint and cold glue labels are one way we can help minimize our impact," adds Damron. "There is less waste generated in producing cold glue versus p-s labels. There is a 50% reduction in freight costs and storage associated with cold glue labels over p-s labels which are much bulkier and heavier because they include the adhesive and substrate material."

The C&G labeler has a wet glue heater for each of two labeling stations to maintain consistent temperature for automatic, optimal glue application. There are two pneumatic glue pumps and specially designed wipe-down and after-pressing label stations.

CIVision has integrated a three-camera LOMAX P vision system onto

the labeler. The LOMAX P includes three cameras mounted inside the labeler to provide 100% label, capsule, and fill-level quality verification. Two cameras check for front and back label presence/absence, label placement (x/y), label skew, and, most importantly, label identity (verifying brand and varietal information). The third camera checks for capsule presence and placement and fill-level verification. Any bottle with defect(s) listed above will be detected, tracked, and rejected by the vision system.

This is a complete turnkey solution. In addition to detecting defective bottles, the vision system can provide real-time statistical data. Information such as production speed, product code, and reject rate could be accessed via Ethernet.

With this new capability, Hess Collection Winery can take advan-



CIVision touch screen monitor for programming of cameras by bottling line personnel and to review read-out on production.

tage of label economies while not compromising design and package aesthetics.



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Figure 1. Extent of typical summer fog intrusion along California coast. (Image created by Mike Bobbitt, Mike Bobbitt & Associates, [www.mikebobbitt.com], Sonoma, CA.)

perature influences vine physiology in numerous ways, including vine growth, timing of phenological events, fruit set, fruitfulness, and perhaps most important, fruit development and ripening.

This article primarily focuses on the temperature component of climate and its effect on fruit ripening from veraison to harvest.

In some ways, the climate of each coastal vineyard is unique. However, trends in temperature-climate do exist and are primarily a function of three variables: proximity to the marine influence, elevation, and site-specific factors. Understanding these three variables provides a framework for assessing the temperature-climate of coastal vineyards.

Proximity to marine influence

The marine influence is the cool air and fog that moves onshore almost every evening in the summer and often remains through mid-morning of the following day (see Figure 1).

The marine influence enters North Coast inland areas through four main passageways because they have the lowest elevation and offer the least resistance to the cold, dense air. From north to south these locations are: the Navarro River, the Russian River, the Petaluma Gap, and San Francisco Bay. The marine air from the latter two passageways has the largest impact on vineyard temperatures in the North Coast. In Monterey County, a strong marine influence enters the Monterey Bay and extends down the Salinas Valley.

A vineyard's proximity to the marine influence has a significant effect on both minimum and maximum temperatures. Using temperature data from a typical summer day from four locations on the floor of Napa Valley as an example (see Figure II), the minimum temperatures are approximately the same, because the marine air that enters Napa Valley near the Carneros and extends to Calistoga has a fairly consistent temperature (about

Nuances of temperature/climate in coastal California winegrowing

BY Theo Csavas, Senior Viticulturist, Jackson Family Wines, Santa Rosa, CA
Mark Greenspan, Advanced Viticulture, Santa Rosa, CA
Daniel Roberts, Integrated Winegrowing LLC

California's premium winegrapes are mostly grown in the coastal viticultural regions ranging from Santa Barbara

County in the south to Mendocino County in the north. While soils in these regions vary, the common factor making them all premium wine production regions is their coastal climate.

The term climate comprises numerous components — temperature, humidity, precipitation, wind, solar radiation, fog, etc. Of all climatic components, however, temperature probably has the single largest influence on viticulture. Air tem-

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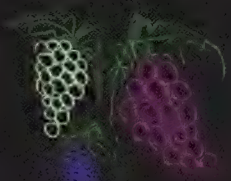


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Figure II: Four locations on Napa Valley floor.

53°F) (as shown in Figure IV). However, the maximum temperatures are very different because the volume of cold air that reaches Calistoga is much smaller and therefore more quickly reheated after sunrise.

Proximity to a marine influence is not the same as the absolute distance to the ocean. Two vineyards could be the same distance from the ocean but if one location is separated from the ocean by mountains, it will be less affected by the marine layer, and will have higher daytime temperatures.

The large gradient in maximum summer temperatures is a special aspect of California coastal areas. In other growing regions, the temperature does not change much by moving many miles in one direction or another. In California coastal areas, a few miles can make the difference between being able to consistently ripen a grape variety consistently or not.

For example, the Carneros district is well suited for Pinot Noir, but less than 10 miles up valley the higher maximum temperatures make the climate better suited for Cabernet Sauvignon.

The specific environmental factors that create the West Coast climate are not found in other coastal growing regions of the world, except perhaps in Chile. These factors are described in *Weather of the San Francisco Bay Region*.²

Elevation

The second factor that affects a location's temperature-climate is elevation, which affects temperature in two ways.

First, elevation determines the extent to which a vineyard is affected by the marine influence. The significance of this is shown in Figure III, taken at 2,000 feet elevation at approximately 9 AM. The air temperature at the vineyard in the picture is warm (about 65°F) and vines are in full sunlight, while vineyards in the fog are cool (about 53°F) and are receiving less sunlight. Through this interaction with the marine influence, elevation affects air temperatures in the evening, at night, and in the morning.

Second, daytime temperature decreases with increasing elevation. For each 1,000-foot increase in elevation, air temperature decreases by about 5°F due to decreasing air pressure at greater elevation. This is called the lapse rate.

The important implications that elevation has for viticulture become clearer when comparing diurnal temperatures at different elevations. Figure V shows the average diurnal temperatures of three weather stations located between 400 and 2,200 feet.

The valley floor vineyard (400 ft.) is most affected by the marine influence, and hence has the lowest average temperature at night (~53°F).

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Figure III: Vineyard above the marine layer.

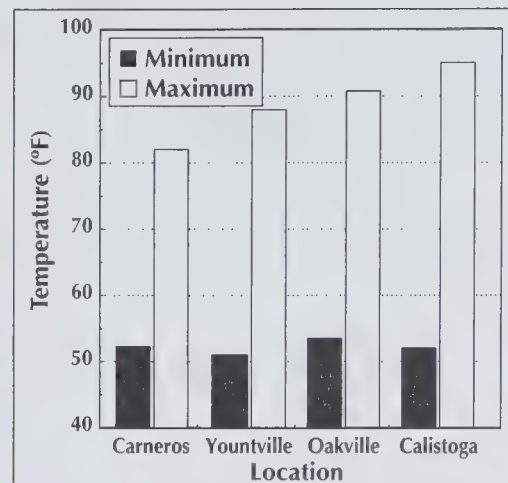


Figure IV: Daily maximum and minimum temperatures.

The middle mountain vineyard (about 1,500 ft.) is often above the marine layer and therefore has a warmer nighttime average temperature (~58°F).

The mountaintop vineyard (2,200 ft.) is always above the marine layer and



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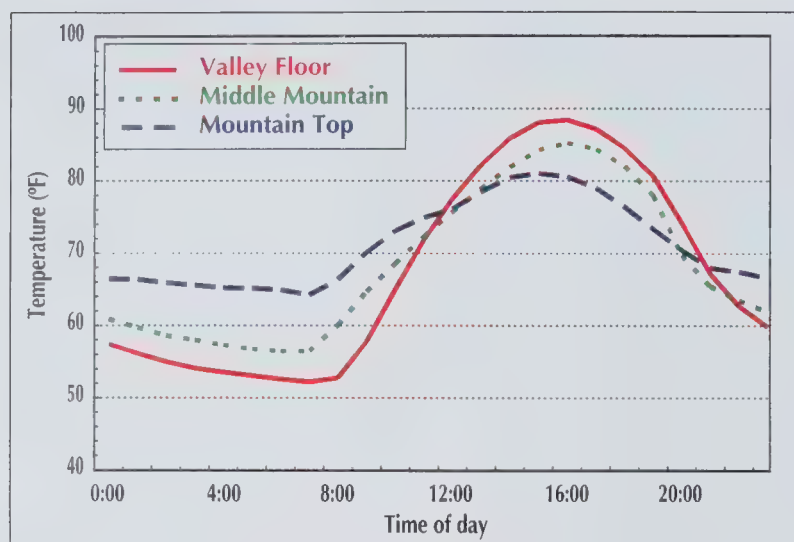


Figure V: Average diurnal temperature amplitude (ADTA) of three locations, daily.

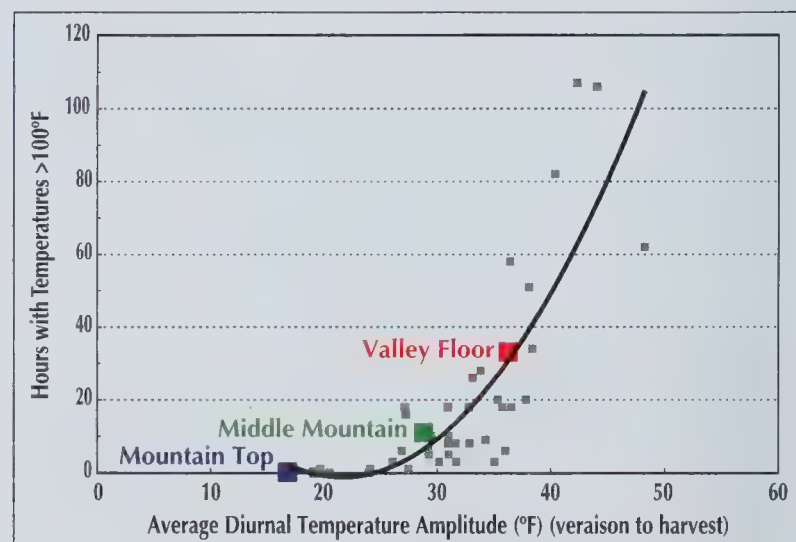


Figure VI: Relationship between two assessments of temperature during the ripening period.

thus has the highest average temperature at night (~64°F).

Even though the mountaintop location is warmest at night, and begins heating up earlier in the day, its maximum temperature is 10°F cooler than

the valley location (400 ft.). The lower daytime temperature occurs because of the lapse rate.

In spite of the large differences in diurnal temperatures, it is interesting to note that the valley and mountain

locations have nearly identical accumulated heat unit values.

The bars in Figure V next to the temperature scale show the difference between the average maximum and minimum temperatures. This is the

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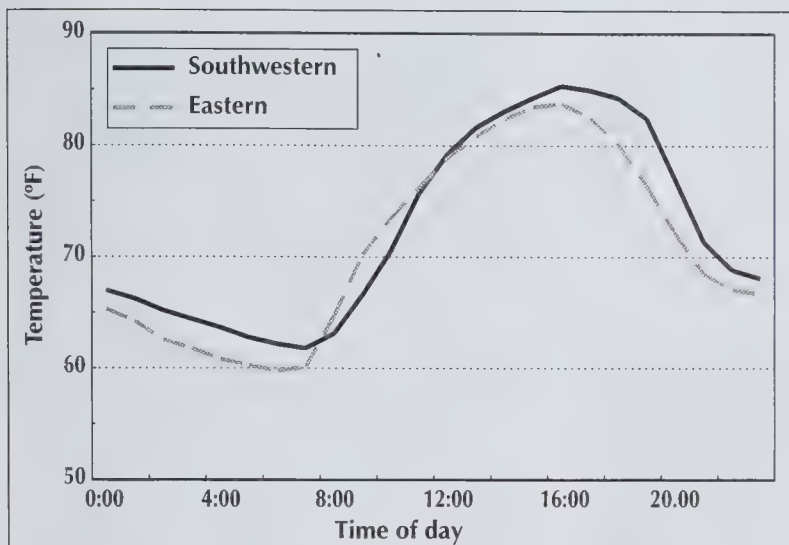


Figure IX: Influence of aspect on average diurnal temperature.

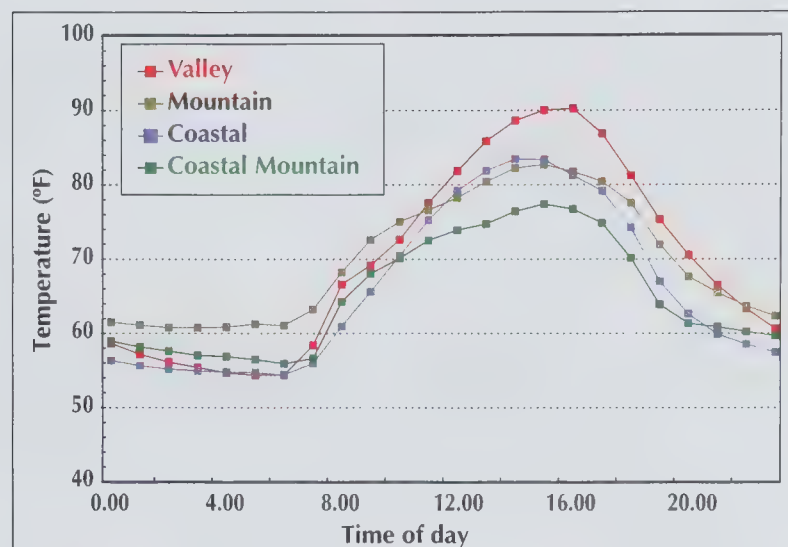


Figure X: Average diurnal temperature of four climatic regions.

average diurnal temperature amplitude (ADTA).

There is an important relationship between the ADTA and the number of hours with temperatures greater than 100°F. The data show that locations with larger changes in ADTA generally

have higher numbers of hours of hot temperatures (Figure VI).

The biochemistry of fruit ripening is largely determined by temperature. Research has shown that fruit exposed to direct sunlight can be 15°F warmer than the ambient temperature.⁴ Periods of high

temperatures before or at veraison can disrupt anthocyanin synthesis in the fruit.

High berry temperatures reduce the activity of enzymes that produce anthocyanin pigments and also increase the rate of anthocyanin degradation. In Figure VIII-a, the berries on the outside

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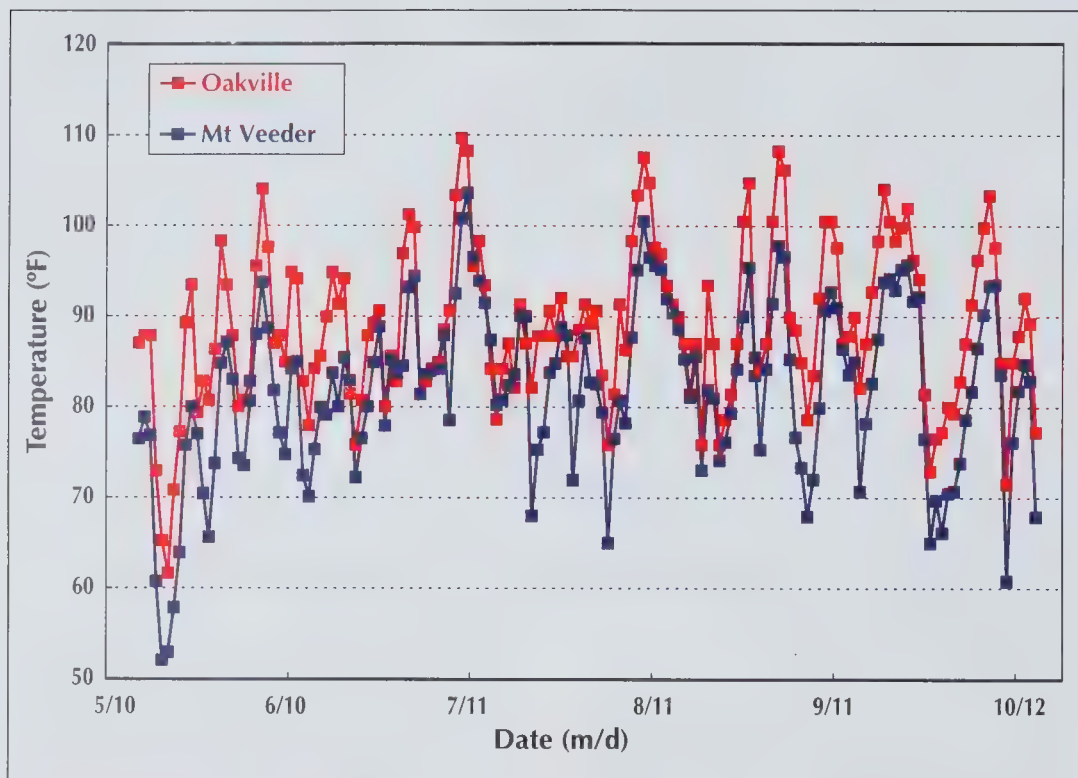


Figure VII: Comparison of maximum daily temperatures in 2002.

of the cluster, which are exposed to the afternoon sun, show a muddy pink color that will never properly develop.

Near harvest, high temperatures can cause fruit to shrivel from dehydration. White varieties are less apt to experience dehydration because their color reflects more solar energy; consequently they do not get as hot.

Dehydration results from enhanced evaporation of the berry, or from a shutting-down of sap flow into the berry. Once berry shrivel commences, it cannot generally be reversed by irrigation. If the fruit shrivels at harvest, the concentration of sugar increases rapidly, but without a concurrent maturation of flavors (see Figure VIII-b).

For vineyards with many days at high temperatures, the fruit must be protected from overheating and dehydration with row direction, canopy, and trellis management.

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Figure VIII-a: Heat Damage — Veraison

The ripening characteristics of the mountaintop location will be quite different from those of the valley.

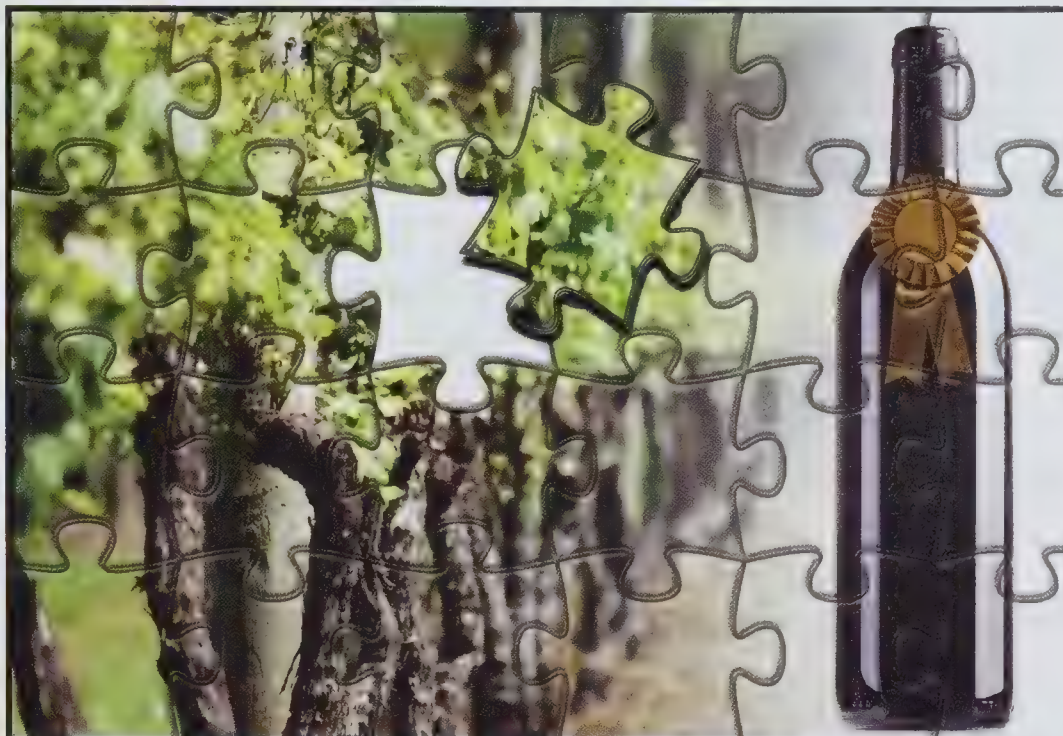


Figure VIII-b: Heat Damage — Harvest

Generally, vineyards at higher elevations and those closer to the marine influence have lower ADTA values and therefore fewer hours with temperatures greater than 100°F. Figure VII shows the maximum daily temperatures for Oakville (190 feet elevation) and a vineyard on Mt. Veeder (1,400

feet elevation) in 2002, an unusually hot year.

During nine periods of hot weather, high temperatures were very common at Oakville, but Mt. Veeder rarely experienced temperatures over 100°F. Between veraison and harvest (August 1 to October 1), Oakville recorded 12



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days with temperatures over 100°F, compared to one day on Mt. Veeder.

Generally speaking, cooler days with warmer nights are advantageous for fruit ripening, reducing risks for heat injury, and allowing flavors to fully develop.

In valley floor vineyards, sugar can accumulate faster than flavors due to higher daytime temperatures. That being said, there are many vineyards on the valley floor where good vineyard design (such as row direction), and canopy and irrigation management, consistently produce excellent wines.

Site-specific factors

There are many site-specific factors that influence climate, including slope, aspect, tree shade, local topography, and air drainage patterns. Site-specific factors can have subtle or dramatic effects on temperature-climate.

Figure IX shows an example of the effect of aspect on average diurnal temperatures. The data are from two weather stations, one with an eastern aspect and one with a southwestern aspect of a single vineyard.

The diurnal temperatures show that the location with the eastern aspect begins heating earlier in the day, but also cools much earlier in the day. The location with a southwestern aspect has higher maximum temperatures. Such differences in diurnal temperatures produce different rates of ripening.

Perhaps the most significant site-specific factor is the effect of local topography on air drainage patterns. On windless nights, cooler air settles in the low spots, while higher elevations remain warmer. The effect can be on a large scale (by a mountain) or a small scale (swales within a vineyard block); the lower nighttime temperatures of eastern aspect in Figure IX are due to

its location in a low spot. In either case, stable nighttime air becomes layered with cooler air near the ground and warmer air higher up. This is often an important factor both for fruit ripening and frost occurrence and severity.

Five climatic regions of the California coast

California's viticultural areas have traditionally been divided into the five growing regions proposed by A.J. Winkler.³ While that system has been very useful it has often masked important, sometimes subtle, differences in temperature climate.

Based on differences in proximity to the marine influence and elevation, vineyards in the north and central coasts can be classified into six climatic regions: Valley, Mountain, Coastal, Coastal Mountain, Inland Valley, and Inland Mountain. The diurnal temperature profiles during ripening show how each of the six regions are different.

Valley regions (such as Napa Valley, Alexander Valley, and Sonoma Valley) have consistently cool nighttime temperatures (about 53°F), because their low elevations are typically under the influence of the marine layer. Typical average maximum temperatures are in the upper 80s to low 90s.

Neither high winds nor persistent fog are major factors. Days with high temperatures frequently occur. Grape varieties grown in valley locations include Cabernet Sauvignon, Merlot, Syrah, Chardonnay, Malbec, Cabernet Franc, and Sauvignon Blanc. Any grape variety will ripen in valley locations, but exceptional wines are made in locations where soil and viticulture are optimal.

Mountain regions (such as Howell Mountain, Mt. Veeder, and Spring Mountain) have temperatures at night in the 60s because the elevation (approximately 900+ feet) often places them above the marine influence. Mid-day temperatures are typically in the 80s. At these locations, temperatures are rarely greater than 100°F. Mountain regions grow the same varieties as valley regions, but the grapes ripen with different flavor profiles.

Coastal regions (such as Russian River, Carneros, Petaluma Gap, Santa Maria, and portions of the Salinas

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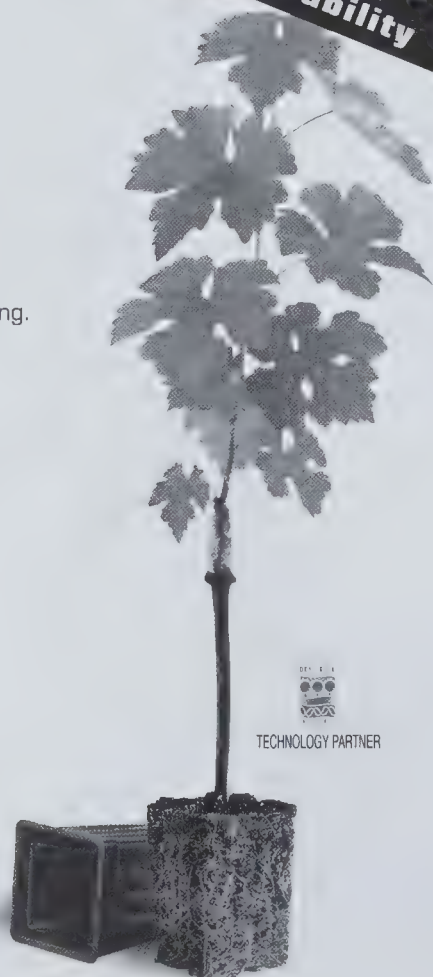
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Valley) have consistently cool night temperatures (about 53°F) because of the low elevation. These areas have relatively cool daytime temperatures (70s to mid-80s) because of the strong marine influence.

Depending on the location, there can be varying amounts of wind and fog. Periods of high temperatures do occur, particularly in the spring and fall, when the onshore airflow is weak and the marine layer is shallow. Grape varieties suited to these areas include Pinot Noir, Chardonnay, Merlot, and Syrah.

Coastal Mountain regions (such as portions of the Sonoma Coast, Santa Cruz Mountains, and Santa Rita Hills), have cool daytime temperatures (70s to low 80s) because of the elevation and proximity to the marine influence. They have warmer night temperatures (low 60s) because they are often above the marine influence.

Coastal Mountain locations are often windy. Even during heat waves, these areas rarely experience high temperatures. Only the earlier ripening varieties (Pinot Noir, Chardonnay, and Syrah) are grown in these locations, but will ripen late in the season.

Inland Mountain regions (e.g. Lake County) have a range of climates due to the interaction of local air drainage patterns and elevation. Since the marine influence does not reach Lake County there is no fog, and the volume of cool air is substantially smaller than in Valley and Coastal locations.

Temperatures tend to rise quickly each day because of the smaller volume of cool air. The maximum daytime temperatures are warm (upper 80s to 90s) but because of the elevation, periods with very high temperatures are less likely than many Valley locations. The wide variety of temperature-climates allows for cultivation of a wide variety of moderate to warm-climate varieties, such as Sauvignon Blanc, Merlot, Zinfandel and Cabernet Sauvignon.

Inland Valley regions (for example Pope Valley and Paso Robles) have large amplitudes in average diurnal temperatures during ripening. Daily minimum temperatures are often quite cool (low 50s or below) and are more the result of local air drainage patterns than of the marine influence. Daytime

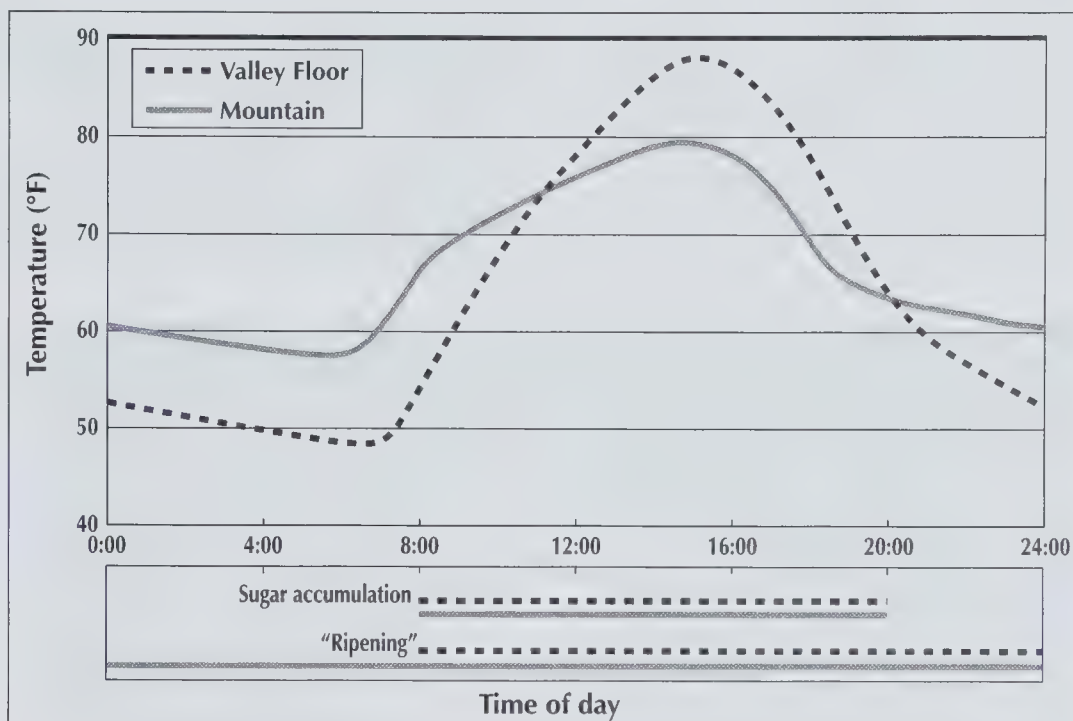


Figure XI: Comparison of ripening and sugar accumulation periods for valley floor and mountain locations with different average diurnal temperature patterns.

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temperatures tend to rise quickly and maximum temperatures are often high (90s and above).

The hot days in these locations would seem to compromise them as high quality wine regions, but the cold night temperatures preserve fruit acidity and delay ripening sufficiently to support

vineyards intended for high-end wines. These locations are well suited for varieties adapted to the warmest climates.

Figure X has examples of the diurnal temperatures of four regions (the Inland regions were left out to make the graph easier to read). Categorizing locations in terms of the five climatic regions illus-

trates the important role that temperature-climate plays in fine wine production. In reality, elevation and proximity to a marine influence are continuous variables, so the five categories do not represent discrete groups but are benchmark classifications.

Importance of smaller diurnal temperature fluctuations

The popular pronouncement about a region's "warm days and cool nights" is not necessarily describing an ideal situation, though if a region has warm or hot days, cool nights are essential to prevent rapid acid metabolism in the fruit during ripening.

A climate with warm/hot days and cool nights produces a different wine style than a climate with similar heat summation units having warm days and relatively warm nights (see Figure XI).

When nighttime temperatures drop down to or below 50°F, berry respiration slows or stops, as does the ripening process. When night temperatures hover somewhere above that threshold, ripening continues into the night hours.

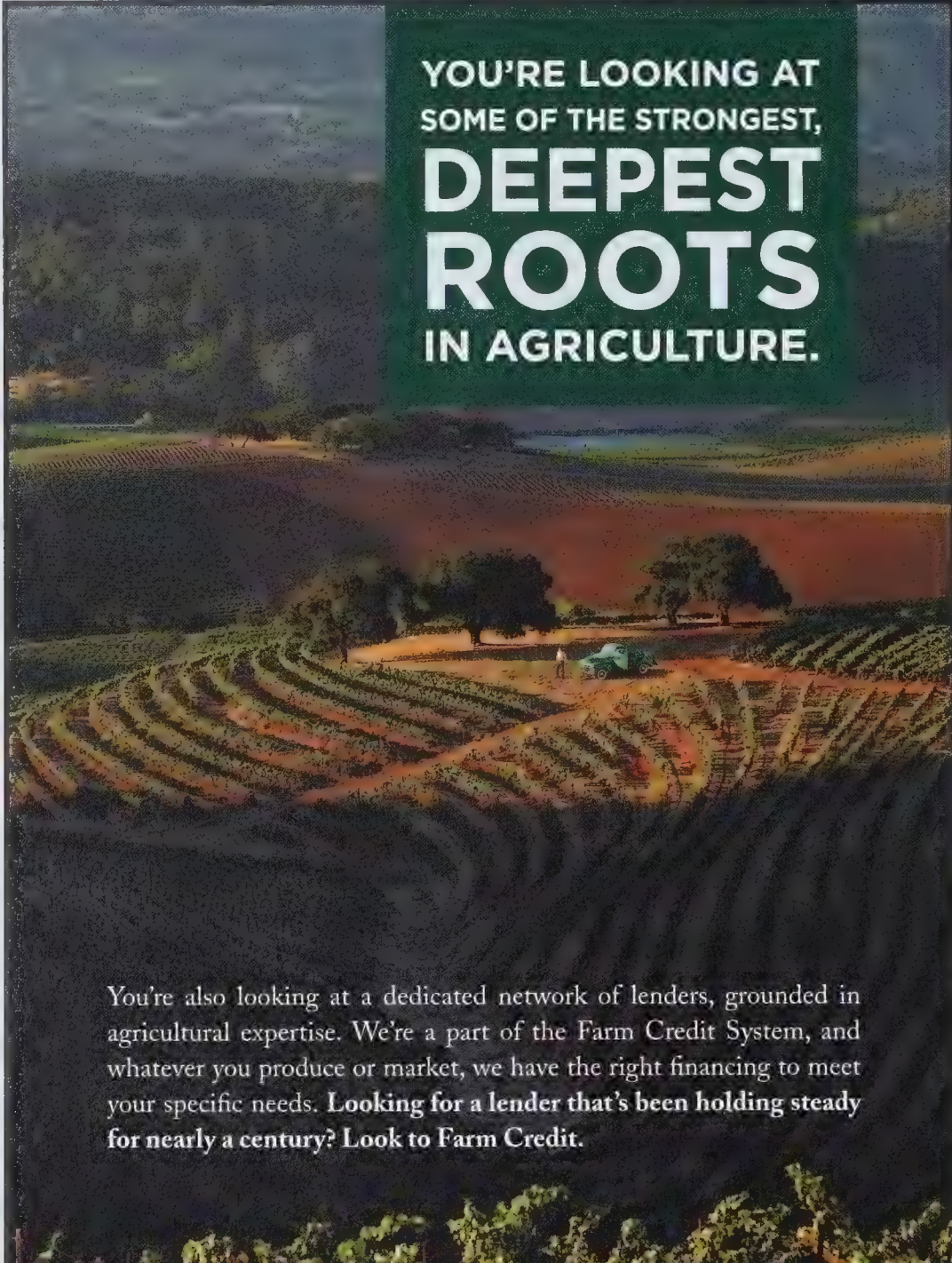
Assuming that the daytime temperatures approach optimum temperatures for ripening, the smaller diurnal temperature swings generally produce fruit flavor maturity more quickly than climates with larger diurnal fluctuations, relative to sugar accumulation. That is because sugar production only occurs during daylight hours, as it requires sunlight.

Hence, for any grape variety, climates with small diurnal temperature swings generally ripen fruit at lower sugar concentrations than do climates with large diurnal temperature swings (with similar seasonal degree days).

In his book *Viticulture and the Environment*, John Gladstones proposes that a narrow range of day-to-day temperature variation during ripening results in greater grape flavors, aromas, and color.¹ That is, indeed, what is often found in practice.

Vineyard sites with smaller diurnal fluctuations allow a winegrower or winemaker to have more choices about when to harvest the fruit, since they will not consistently be considering harvest only when fruit has begun to

Continued on page 69



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BOTTLING₂ Managing oxygen ingress at bottling

BY Dr. Vincent O'Brien,
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Mai Nygaard, business/
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We present results from cutting-edge research that sheds light on a significant wine quality issue confronting the wine sector: management of oxygen ingress in bottles. This research involved benchmarking how well current oxygen management practices are being performed at bottling in selected wineries in Australia.

The study was conducted by the Australian Wine Research Institute Commercial Service and Nomacorc using PreSens technology for oxygen measurement in wine bottles. Mai Nygaard, Nomacorc's Business and Brand Development Manager, was invited to co-author this report.

Oxygen, friend or foe?

Keeping oxygen out of wine is like trying to stay dry in a swimming pool!

Oxygen can have a significant impact on wine style. Low oxygen ingress levels typically tend to lead to wines displaying elevated fresh fruit attributes, absence of developed characters such as toasty and honey attributes, and a tendency to form undesirable reduced characters.

On the other hand, too much oxygen can lead to subdued fresh fruit characters, the development of

stewed and cooked fruit, along with other, developed attributes, the absence of reduced characters and the early onset of undesirable oxidized attributes.

Oxygen's impact is so dramatic that the same wine exposed to slightly different oxygen levels at and after bottling can result in completely distinct products.

For example, closure benchmarking studies widely published in the literature repeatedly demonstrate that oxygen impacts significantly on wine style.^{1,2,3,4,5,6}

Development of reductive characters in wines was discussed in our September/October 2008 *Australia and New Zealand Wine Industry Journal* column and will not be discussed further other than to state that evidence such as that shown in Figure I shows significant levels of reductive attributes can develop in a wine, subsequent to bottling under a closure with low oxygen transmission rate (OTR), despite the

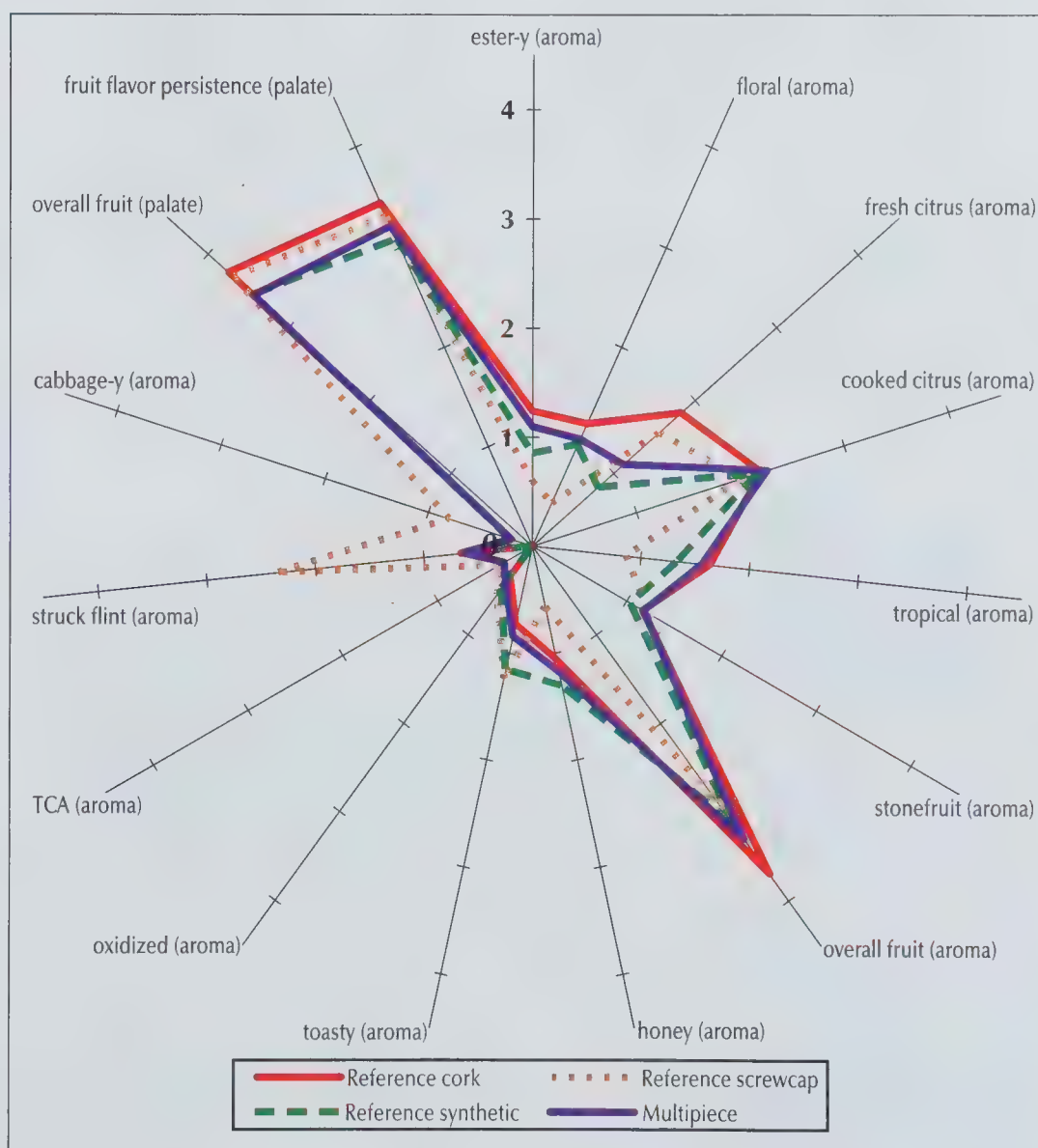


Figure I. Example of a sensory evaluation of a Semillon wine under four different closure OTRs. Data collected 18 months post-bottling (AWRI Commercial closure trial 2008).

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wine being adequately copper fined prior to bottling.

Low molecular weight sulfide compound analysis of the wines in Figure I have shown trace amounts of the compound methanethiol (rotten cabbage, burnt rubber, putrid attributes) were present in the wine under the low OTR

closure that were not present in the other wines showing no reductive characters (AWRI Commercial closure trial 2008).

The shelf life of a wine is typically dictated by the onset of oxidized character in a wine, which can be associated with, as a rough rule of thumb,

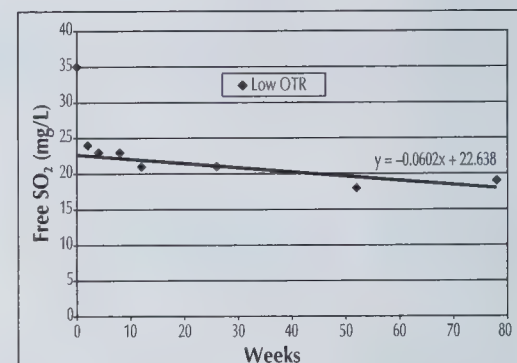


Figure II. Free SO₂ decay subsequent to bottling with a low OTR closure. The development of free SO₂ over time from the point of bottling. The initial free SO₂ content at the time of bottling was 35 mg/L.

free SO₂ level dropping to less than 10 mg/L in the wine.

The majority of red and white wines have free SO₂ levels around 30 to 35 mg/L at bottling. Given that 1 mg/L of oxygen leads to the depletion of approximately 4 mg/L free SO₂,⁷ exposure of wine with 30 mg/L of free SO₂ to as little as 5 mg/L of oxygen can result in SO₂ depletion to critical levels and the onset of oxidized character.

In summary, the effect of oxygen ingress at and after bottling is critical because it:

- impacts on wine style;
- can cause the onset of wine faults;
- determines wine shelf life; and
- presenting carefully crafted wines to the market place in the form that winemakers intend can therefore only be achieved with effective control of oxygen ingress levels at and after bottling.

Furthermore, effective management of oxygen levels in wine involves providing a desired wine style for your consumers at the point of consumption. Too little oxygen can lead to the development of reduced characters or the slow onset of desirable developed attributes. Too much oxygen can cause premature loss of fresh fruit characteristics and the development of oxidized attributes.

Bottling operations

One of the largest sources of oxygen ingress into wine occurs during bottling. Figure II shows a typical decay of free SO₂ in wine after bottling, for a wine bottled under a low OTR closure. Figure II shows approxi-

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mately 50% of the decline in free SO_2 before the wine's shelf life is reached (based on a 10 mg/L limit), occurs within one month of bottling. The rapid initial rate of free SO_2 decline can be attributed entirely to oxygen entrained in the wine and headspace at bottling due to the near anoxic seal this closure provides.

Bottling line audits using "PreSens" technology

In a collaborative study by the AWRI Commercial Service and Noma-corc, five bottling line audits were conducted using a novel Presens technology (depicted in Figure III). Noma-corc is a distributor of PreSens and has previously validated this technology in similar studies in Europe.

PreSens uses the oxoluminescence principle to provide reliable measurements of headspace oxygen levels and wine dissolved oxygen levels through the technical capability tied up in the oxygen sensor spot. A light emitting diode (LED) provides an blue light excitation pulse to the oxygen sensor spot, which returns a fluorescence red light signal indicative of the oxygen concentration. Two oxygen sensor spots are glued inside a bottle, one in the headspace region and one in the side of the bottle as depicted which can be passed down bottling lines under standard operating conditions.

The technology was applied at five different bottling lines during October/November 2008. Four lines were commercial operations while one was a smaller experimental bottling line with no vacuum applied. Results from a bottling audit performed during a run on a commercial bottling line are shown in Figure IV.

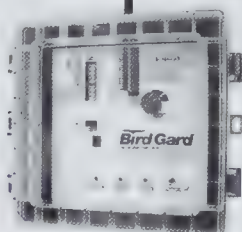
The results shown in Figure IV highlight the following:

- similar dissolved oxygen (DO) values in the wine were obtained using the PreSens and the winery's quality control measurement which used an Orbisphere 3650 oxygen analyser,
- dissolved oxygen levels in the wine were well below the production quality control set point of 1 mg/L; and
- oxygen levels in the wine headspace contributed to the total level of oxygen



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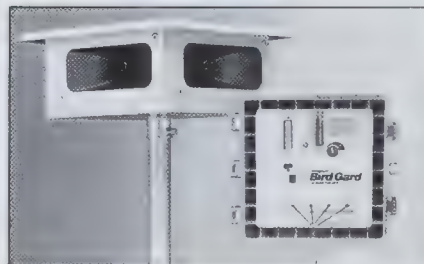
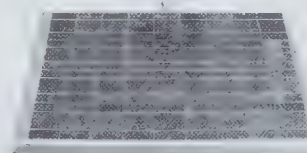
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in the bottle, resulting in it slightly exceeding the quality control set point.

Results obtained from all five audits are depicted in Figure V which shows the following:

- total oxygen ingress at bottling varies significantly between different bottling lines; and

- most of the oxygen entrained in the bottle resides in the headspace.

Headspace management

The bottling line audit results suggest that in many bottling facilities a large amount of oxygen is entrained into the bottle in the headspace. Table I

Table I: Potential headspace oxygen levels

750 mL bottle	Screw cap	Cork (headspace — 15kPa)
Ullage (mL)	10	4.5
O ₂ (mL)	1.8	0.8
O ₂ (mg/L)	3.3	1.5
SO ₂ loss (mg/L)	13.3	6.0

shows potential levels of oxygen in an untreated headspace and the resultant impact these oxygen levels could have on free SO₂ levels in the bottle. Obviously these levels of oxygen have a significant impact on shelf life of a wine and are likely to have a significant impact on wine quality.

Current technologies used to manage headspace oxygen levels at bottling include the following:

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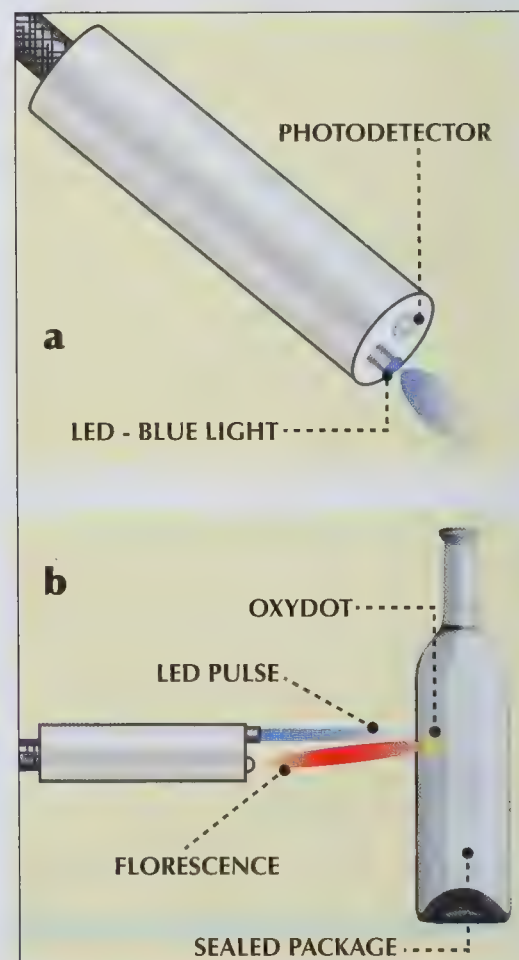
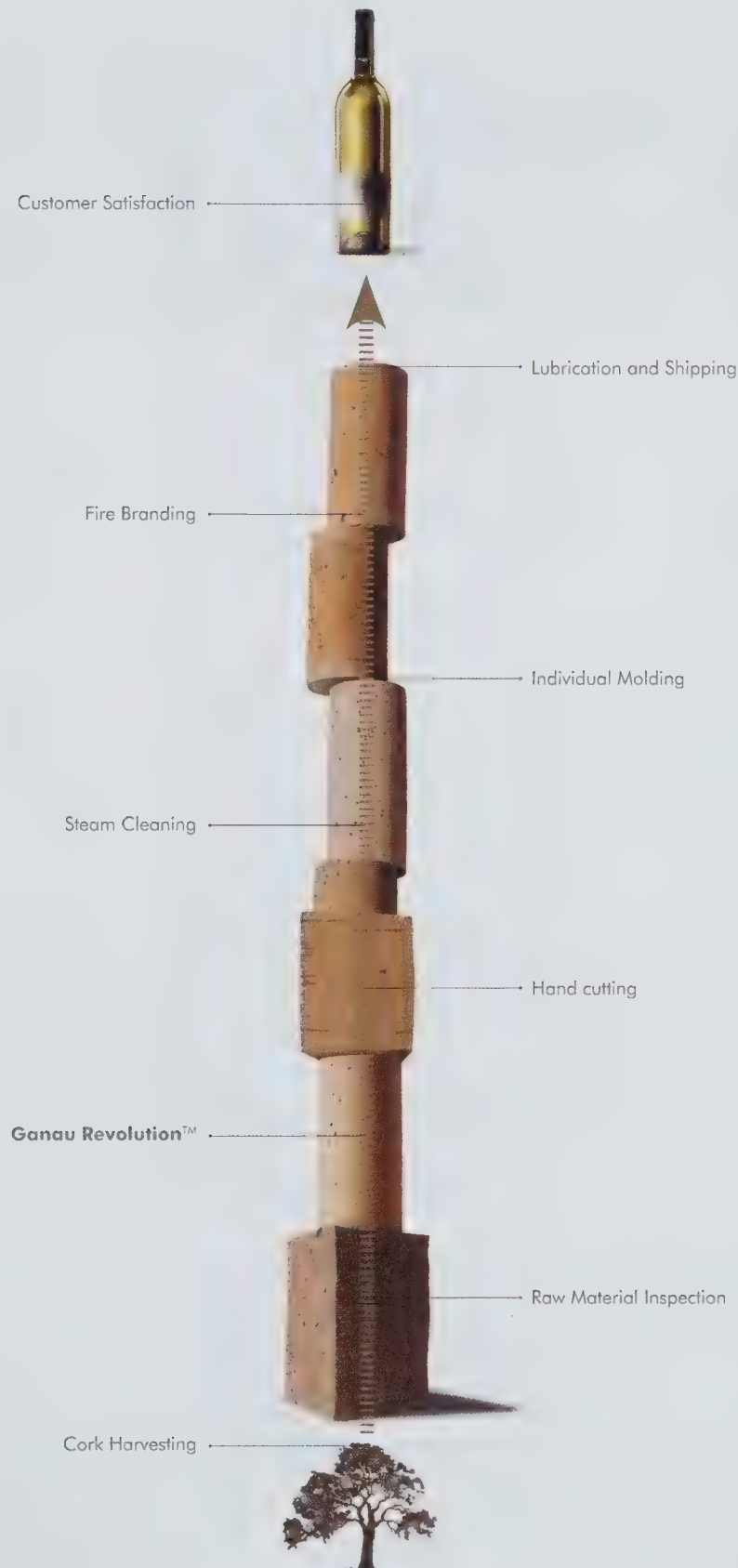


Figure III: PreSens Operating Principle. PreSens technology and wine bottle application (PreSens/Nomacorc, 2008); a) photodetector, b) illustrates application for measurement of oxygen in a bottle containing an oxoluminescent "oxygen sensor spot."

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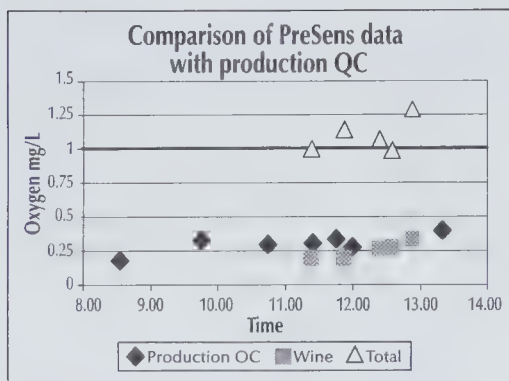


Figure IV: Oxygen data collected during a bottling run at a commercial winery. Dissolved oxygen by Orbisphere (Production QC). PreSens data include dissolved oxygen (wine) and dissolved + headspace oxygen (total).

- nitrogen gas sparging followed by filling and closure application in a nitrogen-blanketed environment;
- nitrogen gas sparging pre- and or post-filling;
- liquid nitrogen sparging pre- and or post-filling;

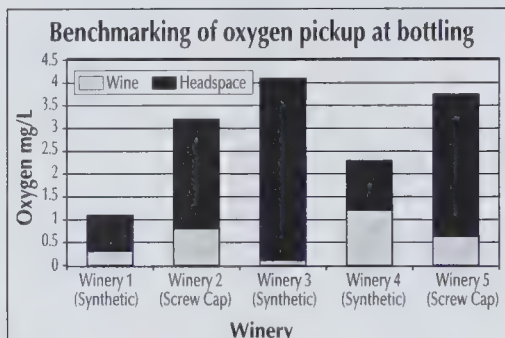


Figure V: Summary of bottling audit results from five different bottling lines.

- CO₂ snow drop pre- and or post-filling; and
- vacuum.

It is our experience that the performance of these technologies varies dramatically depending on how well the process is engineered and controlled. Oxygen quality control strategies used in bottling lines only record the dissolved oxygen level in the wine, leaving the headspace oxygen level completely unmonitored.

Some wineries attempt to account for headspace oxygen levels by either shaking or inverting bottles prior to taking dissolved oxygen measurements. This approach typically will not account for approximately 25% of the total package oxygen level, a ratio dependent on headspace volume, wine temperature and reliably establishing equilibrium of oxygen between the headspace and liquid phases.

Take-home message

Managing oxygen ingress at bottling is critical to controlling wine quality and shelf life. Five bottling line audits (Figure V) conducted using the PreSens technology showed a large part of the oxygen getting into a wine at bottling exists in the headspace, a component which goes unmonitored in many bottling lines. ■

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BOTTLE CLOSURES Oxygen and Wine



BY Richard Gibson,
Scorpex Wine Services,
Adelaide, SA Australia

Oxygen can enhance or reduce wine quality. Certain styles of wine gain complexity and maturity when they are exposed to oxygen under controlled conditions. Uncontrolled and excessive exposure to oxygen, however, usually leads to loss of quality in all wine through the impacts of oxidation reactions on wine color, aroma, and flavor components.

Oxygen is kept away from most white and rosé wines during the wine-making process. This technique, often termed "reductive winemaking," leads to the retention of freshness and fruit characters. In contrast, controlled oxygen exposure is often used during red wine production. This exposure usually takes place while the wine is in the cellar and under the direct control of the winemaker.

Techniques such as barrel maturation, micro-oxygenation (MOX), and racking all facilitate contact of red wine with oxygen. As a consequence of these cellar processes, oxygen is involved in reactions that stabilize color, reduce astringency, and enhance structure.

To achieve optimum results from oxidative maturation, factors such as the rate of oxygen entry into the wine, the length of time for which the wine is exposed to oxygen, and the wine temperature when oxygen exposure occurs must all be carefully managed.

A winemaker generally aims to ensure that oxidative maturation processes are completed prior to bottling. After bottling, the game changes. Normal bottle maturation reactions can occur in very low oxygen conditions. Oxygen exposure after bottling

causes changes to normal bottle maturation that may not be desirable.

Continuing oxygen exposure after bottling has the following sequential effects:

Stage 1: Depletion of reserves of added antioxidants (SO_2 , ascorbic acid).

Stage 2: Oxygen reaction with flavor, color, and aroma compounds, causing loss of freshness and change in style to a more mature sensory profile.

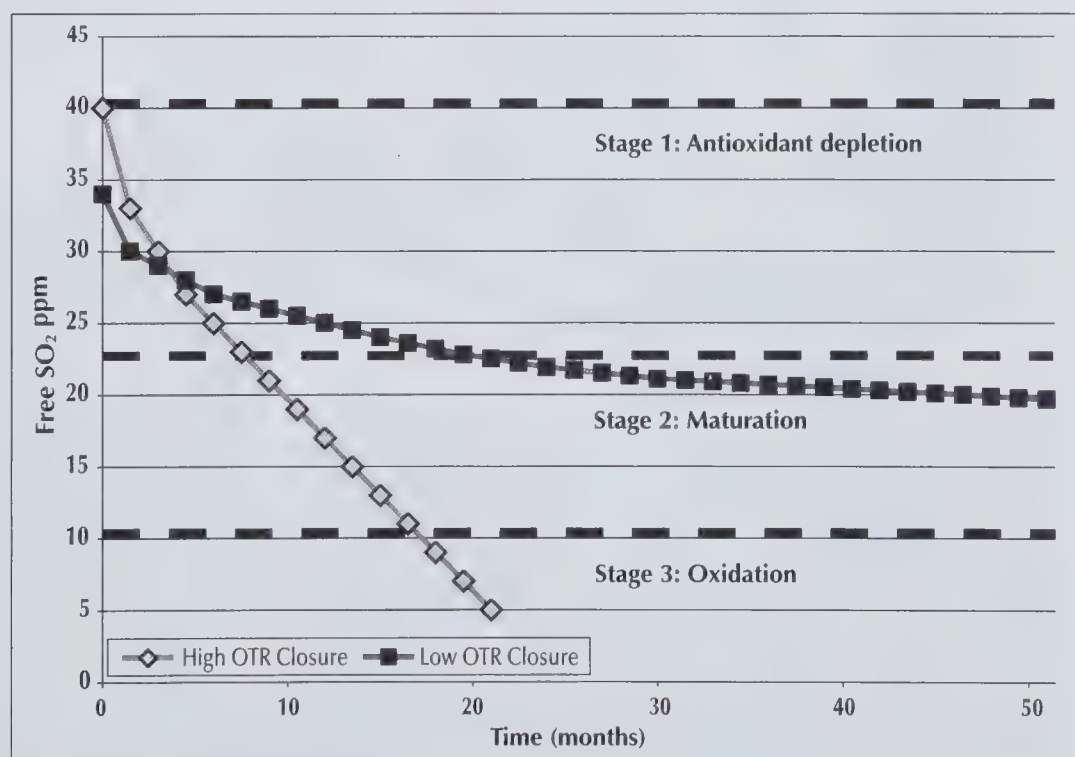
Stage 3: Further oxygen reaction with wine compounds to an extent that the wine becomes oxidized and is no longer suitable for sale.

These effects occur in all package types that allow continuing oxygen ingress, such as BaginBox, plastic bottles, synthetic closures, and screw caps with polymer liners. Given enough time, sufficient oxygen entry will occur for the wine to pass through the stages

described above. The wine will eventually become oxidized.

The length of time required for oxidation to occur will depend on factors such as the oxygen barrier properties of the packaging material and the surface area to volume ratio of the package. Although these effects can be seen in a number of different package types, this discussion will focus on wine in glass bottles sealed with closures that allow oxygen transfer.

Antioxidants play an extremely important role in maintaining quality in wine that is filled into packages that allow oxygen ingress. Sulfur dioxide and ascorbic acid (white wines) can be used to delay the onset of oxygen-induced maturation and oxidation after filling. Use of low levels of antioxidants simply leads to earlier loss of freshness and short shelf life.



Typical free SO_2 depletion curves for high and low OTR closures.

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Molecular SO₂ targets should not be considered when the major objective of SO₂ use is to protect against oxidation. Calculation of required free SO₂ based on molecular targets will ensure a hostile environment for microbial cells at the time of bottling.

However, adherence to molecular SO₂ targets at bottling could leave wine well short of adequate antioxidant reserves. For example, a white wine with a pH of 3.2 requires only 21 ppm free SO₂ to achieve a molecular SO₂ concentration of 0.8 ppm (a level considered lethal to most microorganisms). In a package that allows entry of oxygen, this concentration of free SO₂ will give protection against loss of freshness and oxidation for a limited period, especially if oxygen is present in the bottle and headspace at filling.

After bottling, there is no further opportunity to manage the level of

antioxidants in a wine. It is essential that adequate reserves are present when the wine is filled into a bottle. Put simply, *more* SO₂ (within legal and sensory, color, and flavor constraints) will extend shelf life.

Recent studies have shown that ascorbic acid helps to maintain freshness and maintain free SO₂ reserves in white wines after bottling (Skourounis *et al* 2005). Use of ascorbic acid should be considered to maximize white wine shelf life.

Controlling oxygen uptake at bottling is an extremely important factor in slowing oxidative quality loss in the bottle. Dissolved oxygen in the wine and oxygen in the bottle headspace at filling reacts quickly with antioxidants, lowering the reserve remaining to combat the impact of oxygen ingress through the closure.

Once a bottle is sealed, oxygen can start to enter the wine through some closures. It is well-known that oxygen can diffuse through most plastic materials. Oxygen molecules diffuse in response to differences in oxygen concentration on either side of the material.

Diffusion of oxygen is not affected by the pressure of other gases. For example, carbon dioxide pressure does not prevent oxygen diffusing through plastic sparkling wine closures into the bottle.

Closure oxygen transmission rate (OTR) data has become readily available in recent years. OTR is usually expressed in terms of cubic centimeters of oxygen per day per closure, measured at atmospheric pressure in air. Testing is usually carried out on Mocon equipment. Recently, systems using fluorescent dots (such as Presens and

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Oxysense) have become available. These systems can be also used to measure closure OTR.

Initially, continuing oxygen transfer through closures causes depletion of antioxidant reserves. Wine usually remains in good condition while this stage is in progress. With more time, however, the antioxidant concentration decreases. The wine undergoes accelerated maturation as oxygen starts to react with wine components. With more time, oxidation sets in. The graph below shows typical free SO₂ depletion curves for low and high OTR closures over time:

Wines made under reductive conditions may undergo significant style change if they are exposed to oxygen in the bottle. Wine that has not received sufficient oxidative maturation in the winery may be enhanced by oxygen exposure in a bottle sealed with a high

OTR closure — but only for a relatively short time before oxidation sets in.

With high OTR closures, the window between the time when the wine enters the maturation stage and the time when the wine enters the oxidation stage can be short. In the example above, the wine with a high OTR closure enters the maturation phase nine months after bottling but is oxidized nine months later.

A further complicating factor is that if oxygen entry through the closure is a major factor in achieving maturation, wine will be immature when first released to the market and will not approach peak quality until sufficient oxygen has entered through the closure.

Relying on oxygen transfer through the closure to carry out or complete oxidative maturation of wine involves serious risks, as it is not known how

long after bottling the wine will be consumed. Wine in bottles consumed early may be bitter and astringent, while wine in bottles consumed some time later will be oxidized.

With “bottle on demand” commercial products, there are often batches of wine from different bottling dates in the market place at the same time. If oxygen exposure in the bottle is relied on for maturation, there will be stock of varying style and quality in the market at the same time. Even if oxygen ingress rates can be closely controlled by manufacturing processes, the end product will vary as it is impossible to achieve uniform stock age in the distribution system.

Temperature adds a further complication. High temperatures increase the rate of oxygen reactions with wine components and the rate of oxygen diffusion through closures. Wine temper-



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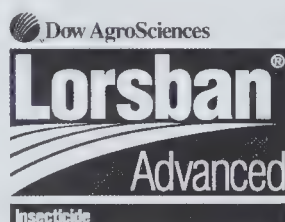
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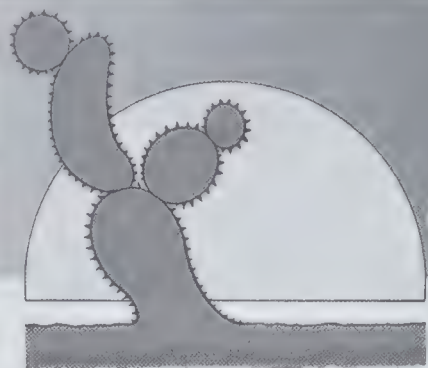


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ature in the distribution system cannot be controlled. This factor adds to the risk of product variation when oxygen entry into the bottle is used to achieve maturation.

In my opinion, winemakers should seek to complete oxidative maturation in the cellar prior to bottling and use low OTR closures to seal the bottle. The intentional use of closures with high OTRs to achieve oxidative maturation in the bottle involves high risk, as the age and temperature of stock in the distribution system cannot be managed to the extent that is required to achieve optimum product quality and consistency.

If a high OTR closure is used, it is best to complete oxidative maturation in the cellar and then ensure that stock is sold and consumed before the antioxidant depletion stage is completed. This requires management of

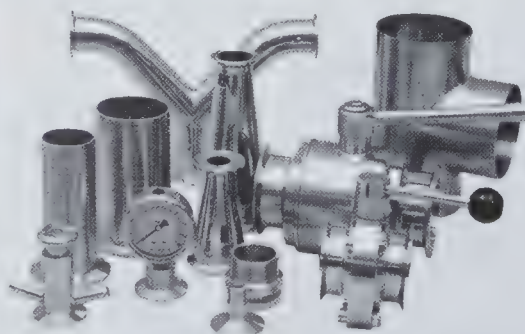


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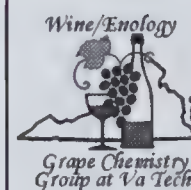
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stock age, but does not introduce the issue of immature stock in the marketplace and the risk of oxidation if product is held in the bottle until maturity is achieved.

Summary

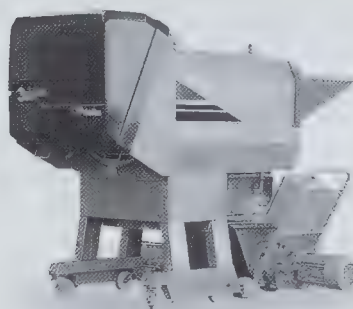
Intentional oxidative maturation in the bottle is a high risk strategy that may benefit a small number of wines for a short time. Inevitably, it will lead to inconsistency, loss of quality, and consumer dissatisfaction in many other wines. ■

Reference

Skouroumounis, G.K., M.J. Kwiatkowski, I.L. Francis, H. Oakey, D.L. Capone, Z. Peng, B. Duncan, M.A. Sefton, E.J. Waters. 2005. "The influence of ascorbic acid on the composition, colour and flavour properties of a Riesling and wooded Chardonnay wine during five years' storage." *Aus. J. of Grape & Wine Research*, 11, 355-368.

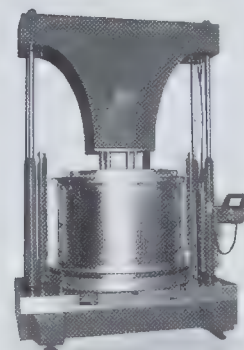
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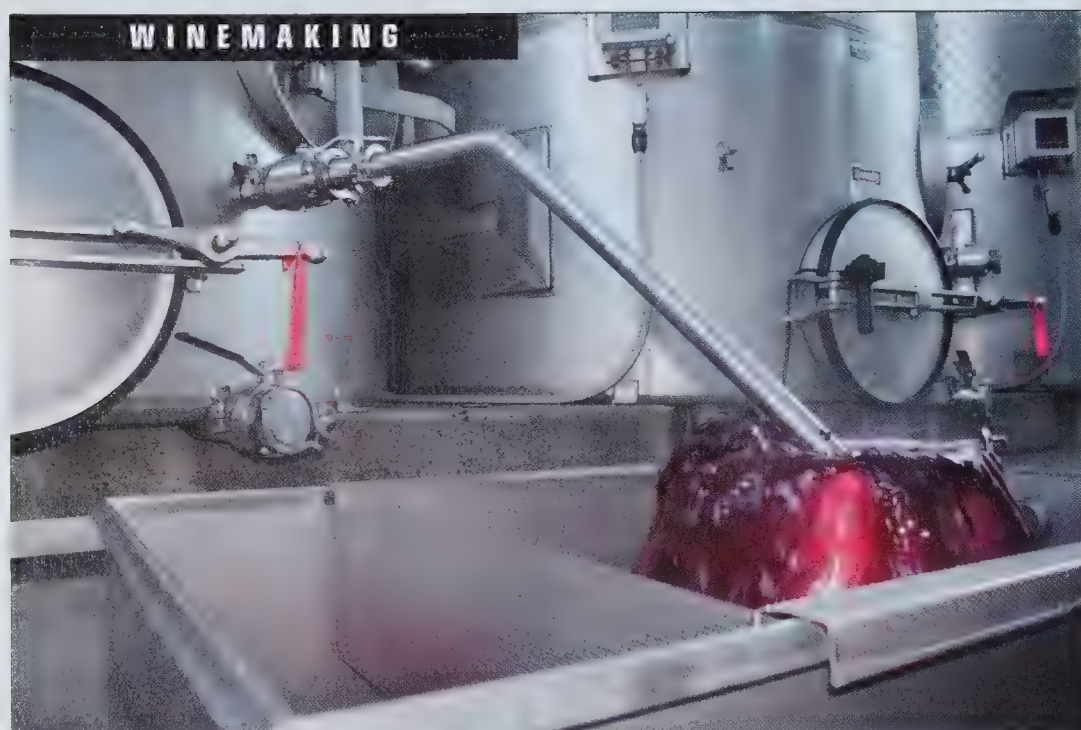
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Aeration across a screen with seed removal during draining of the fermentor. Photo by Wendy Day, Vine Cliff Winery (Napa, CA).

MERLOT AND CABERNET SAUVIGNON WINES

Impact of délestage with partial seed removal

BY Bruce W. Zoecklein^{1*},
Lisa M. Pélanne²,
Sandy S. Birkenmaier³,
Karen Reed⁴

Délestage (rack and return) involving partial seed removal was compared with Merlot produced by manual cap punch down (three years), and Cabernet Sauvignon produced by mechanical punch-down (pigeage) systems (one year).

Fermentation reduced the color derived from monomeric pigments and increased polymeric pigment color for all treatments. Délestage wines generally had more large polymeric pigment color than cap-punched or pigeage wines. Total glycosides increased during cold soak and fermentation, and were in greater concentration in cap-punched Merlot, and

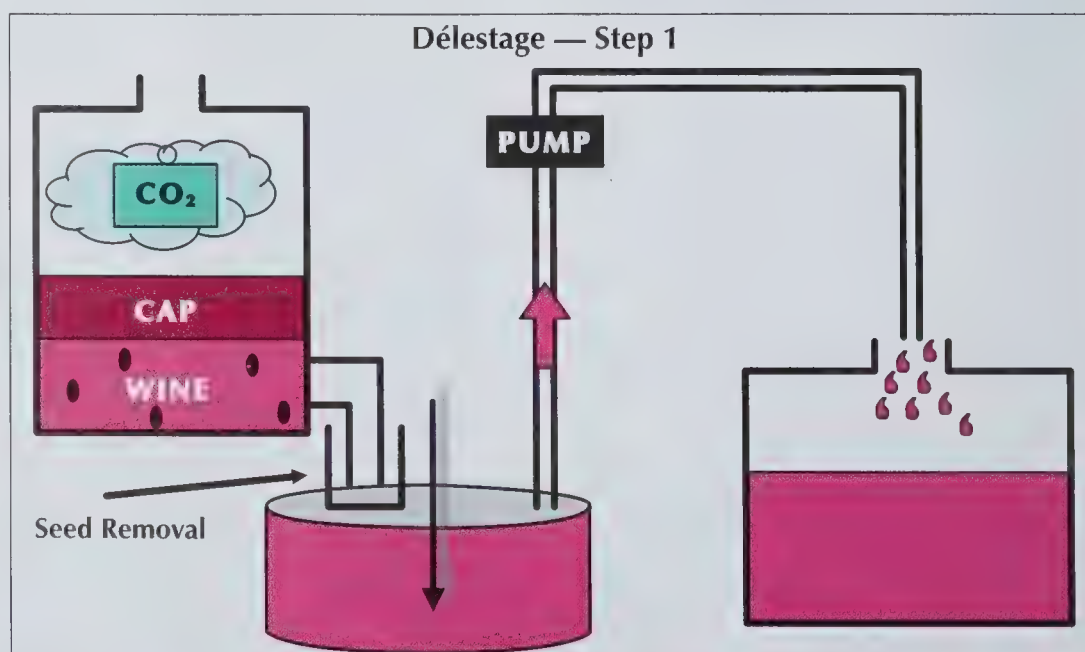
similar among Cabernet Sauvignon treatments.

Discrimination testing (triangle difference analysis) demonstrated Merlot wines generally differed in aroma and/or flavor. Cabernet Sauvignon wines differed in both aroma and flavor.

The color, structure, and aftertaste of red wines are mainly derived from the varied and complex impact of phenolic compounds. It is estimated that 50% or less of the total phenolic compounds present in the skins, seeds, and flesh of grapes can be extracted during conventional winemaking.^{12,36}

The level of extraction depends on various factors, including fruit maturity, duration of skin contact, temperature, ethanol concentration,²⁰ and vinification practices, including cap management techniques.^{7,16,22,31} Therefore, understanding the quantitative and qualitative influences processing has on grape and wine phenolic compounds is important in premium wine production.

Monomeric and polymeric flavan-3-ols comprise the majority of phenolic constituents in red wines,³⁰ being extracted from the skins and outer seed coat during fermentation.³⁸ Polymeric flavan-3-ols, referred to as proanthocyanidins or condensed tannins, arise either by addition of intermediates from flavan-3,4-diols to flavan-3-ol monomers, or by acetaldehyde-induced polymerization.^{8,35}



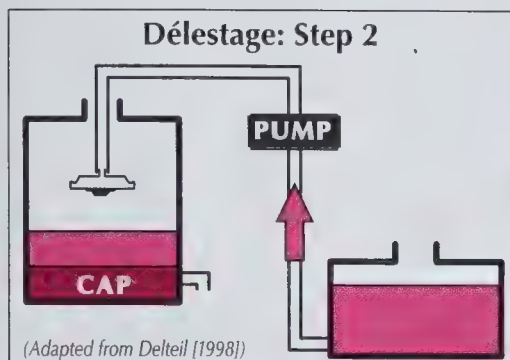
Délestage is a rack-and-return process modified to deport seeds, illustrated here. Fermenting juice was deported from a bottom valve through a dejucing sleeve with holes 1/10-inch in diameter. Seeds were retained within the sleeve, and the deported juice was pumped to a separate tank while the cap was allowed to drain. Process was conducted once per day until the completion of fermentation or dejucing, depending on the particular trial.

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⁴ Viticulture Coordinator, Clos Pegase, Calistoga, CA

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Juice was brought back to top of the fermentation tank using a cap irrigation system. Délestage, therefore, involves two main features which are impacting the tannin profile of the wine (and therefore the structural/textural qualities):

- 1) removal of seeds could reduce the contribution of immature phenols;
- 2) oxidative polymerization could result in partial reduction of monomeric pigments as they are incorporated into large polymeric pigments.

(For more details see www.icv.fr/kiosqueuk/procedure/delestage.htm or www.vtwines.info/enologynotes/onlinepublications)

Grape seeds differ from skins in that seed proanthocyanidins contain greater levels of monomeric flavan-3-ols, and those esterified to gallic acid.^{5,25,32} Additionally, seed proanthocyanidins generally have a lower dp (degree of polymerization) than those found in skins, and no trihydroxylation of the B-ring.⁹ Proanthocyanidins are reactive molecules that may form complex species thought to impact wine sensory features.

Monomeric and polymeric flavan-3-ols induce both astringent and bitter mouth sensations. S. Vidal *et al.* demonstrated that overall astringency increased with increases in dp.³⁸ Additionally, they reported that galloylation increased tannin coarseness, while trihydroxylation of the B-ring decreased coarseness.

Tannins in the skins and seeds can combine with anthocyanidin glycosides (anthocyanins) to form polymeric pigments.³⁶ These pigments are believed to be formed by condensation products of malvidin-3-glucoside and various procyanidins created through acetyl bridges.^{9,26} Anthocyanin-tannin complexes can be produced by binding between the C-4 of the flavylum salt and the C-8 of catechin.^{21,27}

D.O. Adams *et al.* reported extractable seed tannins in Syrah grapes



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Table I: Effect of manual cap punching (control) and délestage on Merlot wine chemistry for three seasons.

	Season 1		Season 2		Season 3	
	Control	Délestage	Control	Délestage	Control	Délestage
Alcohol % (v/v)	12.8a ^a	12.7a	11.5a	11.7a	13.1a	13.1a
TA (g/L)	6.57a	6.70a	6.20a	6.38a	4.85a	4.88a
Tartaric Acid (g/L)	2.21a	1.97a	3.06a	3.41a	1.50a	1.74a
Malic Acid (g/L)	trace	trace	trace	trace	trace	trace
Lactic Acid (g/L)	3.15a	2.23a	3.35a	4.07a	3.87a	2.44a
pH	3.60a	3.66a	3.65a	3.66a	3.87a	3.91a
Total Tannin (mg CE/L)	191.6a	173.0b	177a	150b	197.5a	171.1b
Total Phenol (AU ²⁸⁰)	59.8a	58.3a	43.1a	37.6b	40.1a	37.0b
Total Anthocyanin (AU ²⁰ -AU ⁵²⁰)	ND ^b	ND	3.89a	3.04b	2.37a	2.21b
AU ⁴²⁰⁺⁵²⁰	8.23a	6.92b	8.21a	7.82a	8.87a	7.64a
AU ^{420/520}	0.793a	0.780a	0.794a	0.789b	0.575b	0.585a

^aDifferent letters within rows and years denote significant difference ($p \leq 0.05$) of treatment means; ^bND = not determined; n = 3.

declined by about half from véraison to harvest, and were about three times greater than skin tannin concentra-

tions.² Grape skin phenols are more easily extracted during fermentation than those of seeds and stems.¹⁸

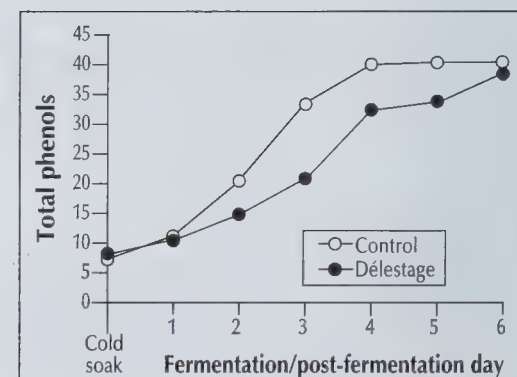
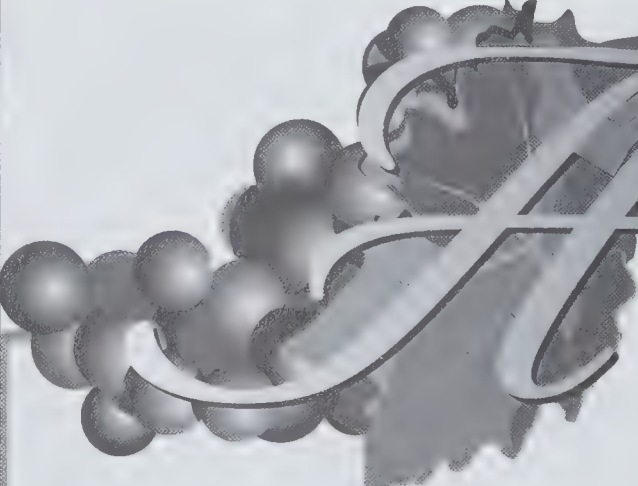


Figure 1. Effect of cold soak, fermentation, and post-fermentation on total phenols of control (cap punched) and délestage-produced Merlot wines in season 3; n = 3.

Although skins contain a lower concentration of total and polymeric phenols than seeds,¹³ they may be the primary source of polymeric phenols in wine.¹⁴ For the first five to seven days of fermentation, phenolic compounds are extracted mainly from skins, followed by extraction from seeds.²³



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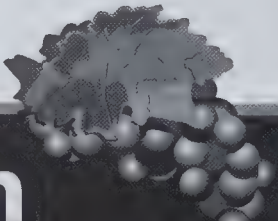
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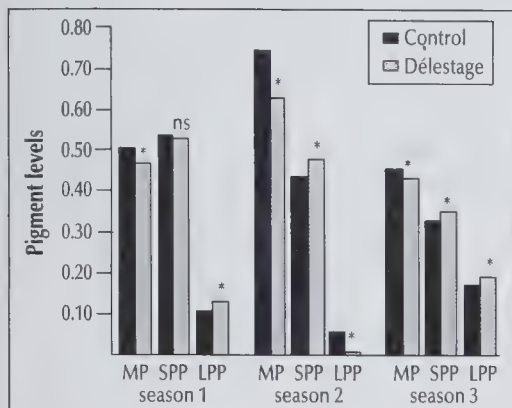


Figure II. Effect of control (cap punched) and délestage on Merlot — percent color derived from monomeric pigments (MP), small polymeric pigments (SPP), and large polymeric pigments (LPP) for three seasons; n = 3.

Table II: Mean values of C/MS phenolic profiles of aged Merlot wines (for three seasons), and Cabernet Sauvignon wine (produced one season). Significant differences were not observed at $p \leq 0.05$.

	Merlot		Cabernet Sauvignon	
	Control	Délestage	Pigeage	Délestage
Gallic Acid (mg/L)	22 ^a	21	55	37
Catechin (mg/L)	23	17	49	39
Epicatechin (mg/L)	14	9	29	16
Caftaric Acid (mg/L)	11	11	<1	6
Caffeic Acid (mg/L)	14	12	16	20
Quercetin (mg/L)	8	4	3	3
Malvidin Glucoside (mg/L)	30	13	20	21
Polymeric Anthocyanins (mg/L)	34	36	36	41
Total Anthocyanins (mg/L)	100	83	71	61
Monomeric Anthocyanins (mg/L)	50	28	25	30

^an = 3

Several reports have suggested that seeds contribute significant concentrations of proanthocyanidins to wines,^{15,29} while others have reported the seed contribution to be limited.^{4,24,39} These contradictory observations may be the

result of differences in cultivar, fruit maturity, and winemaking style.

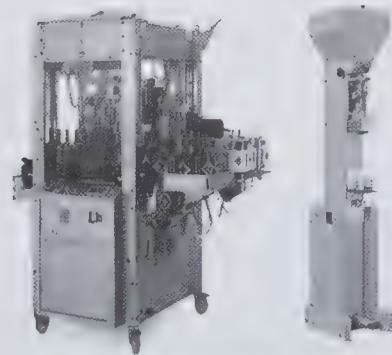
For example, duration of maceration primarily influences the extraction of phenolic compounds from the seeds,⁴⁰ while fermentation tempera-

ture appears to be a primary factor influencing extraction from skins.²³

Délestage, or rack and return, is a maceration technique designed to help optimize the exchange between the liquid and solid phase by emptying the

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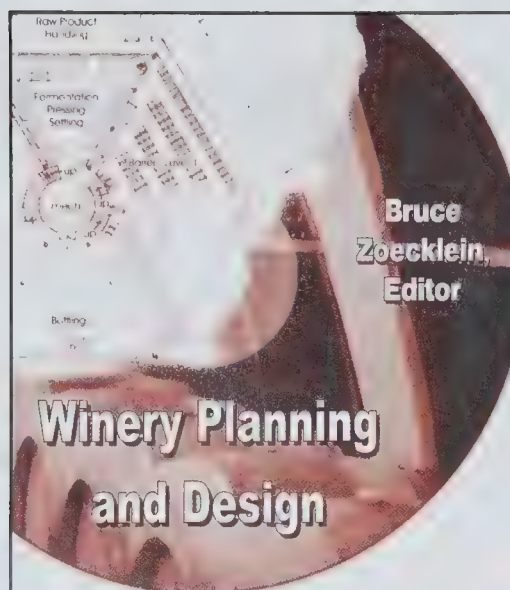


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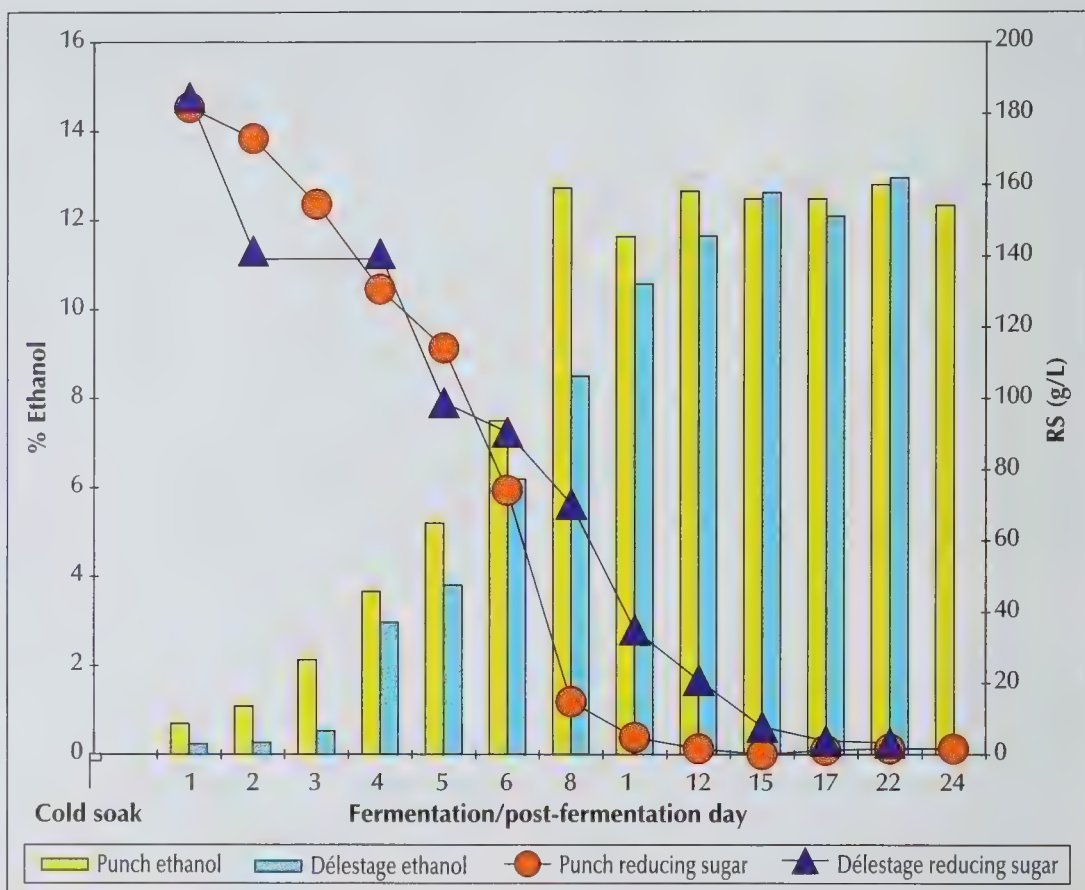


Figure III. Effect of mechanical punch (pigeage) and délestage on Cabernet Sauvignon ethanol production and reduced sugar decrease; $n = 3$.

fermentation vessel of liquid while aerating the juice.

Following several hours of cap draining, the liquid is gently pumped over, or returned, to the cap. This procedure is designed to help oxygenate, while minimizing mechanical grinding of the skins, seeds and stems (Dominique Delteil, personal communication, 2003). This study evaluated délestage in conjunction with partial seed removal, to determine the impact on Merlot wine composition for three seasons and on Cabernet Sauvignon for one season.

Materials and Methods

MERLOT fruit (approximately 8,500 kg), grown in central Virginia, was hand-harvested in each of three years at a minimum of 21.0° Brix (a common soluble solids concentration for Merlot grown in central Virginia). Fruit was immediately destemmed, crushed, and divided into six equal-weight (1,416 kg) replicates. Must fermentable nitrogen levels were measured,¹⁰ and adjusted to 250 mg/L adding either Fermaid K™ (Scott Laboratories, Peta-

luma, CA) or Superfood™ (The Wine Lab, Napa, CA). Sulfur dioxide (30 mg/L) was added at crush to each lot.

Each must was given a cold maceration (cold soak) period of 24 hours at 10°C, prior to fermentation. D-254™ yeast (Scott Laboratories, Petaluma, CA) was hydrated, microscopically examined for budding, viability and purity, cooled to within 3°C of the must temperature, and added to each lot (24 g dry yeast/100 L).

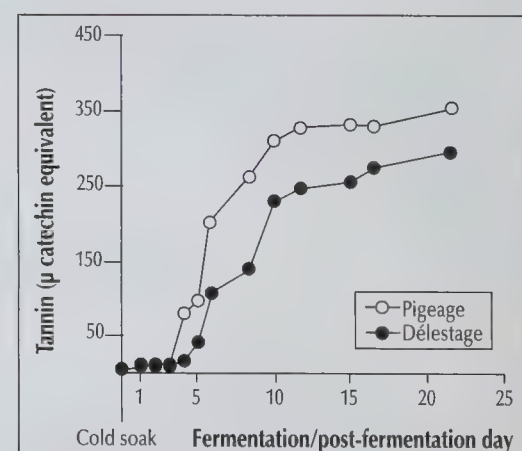


Figure IV. Effect of pigeage and délestage on Cabernet Sauvignon — tannin concentration during cold soak, fermentation, and post-fermentation; $n = 3$.



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Table III: Effect of manual cap punch (control) and délestage on total (TGG) and phenol-free (PFGG) Merlot glycosides for two seasons.

Sample		TGG (μ M)		PFGG (μ M)	
		Control	Délestage	Control	Délestage
Season 2	Post-Cold Soak	386b ^a	435a	157b	191a
	Day 2	1513a	1156b	180b	264a
	Dejuice	2068a	1866b	135b	194a
Season 3	Post-Cold Soak	360b	394a	144a	152a
	Day 2	1260a	1279a	141a	127a
	Dejuice	1583a	1433b	120b	134a

^aDifferent letters within rows indicate significant difference ($p \leq 0.05$) of treatment means; $n = 3$.

The six equal-weight lots were randomly assigned to treatments consisting of 1) control, conventional fermentation, with cap manually punched down two times per day, or 2) délestage, consisting of a rack and return procedure with seed removal conducted once per day until dryness, as follows.

Following cap rise, fermenting juice was drained from a bottom valve through an external cylindrical dejuicing sleeve (2.39 mm diameter holes) into a stainless steel vat. Seeds were retained within the sleeve.

The juice was pumped to a separate tank while the dejuiced cap was allowed to drain freely for two hours. Juice was

Table IV: Effect of pigeage and délestage on Cabernet Sauvignon wine chemistry, and average percentage of color derived from monomeric pigments (MP), small polymeric pigments (SPP), and large polymeric pigments (LPP).

	Pigeage	Délestage
% Alcohol (v/v)	12.4a ^a	12.5a
TA (g/L)	5.19a	5.01a
Tartaric Acid (g/L)	1.36a	1.32a
Malic Acid (g/L)	0.52a	0.52a
Lactic Acid (g/L)	4.12a	3.72a
pH	3.96a	4.01a
Total Tannin (mg CE/L)	337.8a	294.5b
Total Phenols (AU ²⁸⁰)	65.2a	58.0b
Total Anthocyanin (AU ²⁰ -AU ⁵⁰)	2.65a	1.67b
AU ⁴²⁰⁺⁵²⁰	0.616a	0.608b
AU ^{420/520}	0.77b	0.81a
Monomeric Pigment (%)	43.5	34.6
Small Polymeric Pigment (%)	49.6	53.8
Large Polymeric Pigment (%)	6.9	11.6

^aDifferent letters within rows denote significant difference ($p \leq 0.05$) of treatment means; $n = 3$.

then returned to the top of the cap via a tank cap irrigator, using deflection plates to minimize skin breakage. The separated seeds were drained free of liquid, weighed, and discarded.

Treatment and control vessels averaged filled height-to-diameter ratios of 0.64 and 0.75 for the délestage and conventional fermentations, respectively.

Fermentations were conducted at an average liquid temperature of 28°C (range 26° to 35°C) and an average cap temperature of 30°C (range 28° to 37°C) in 1,000-L capacity vessels. Pressing was performed at dryness (2.0 g/L reducing sugar) using a tank press to 1 bar. Free-run and press-run wines were combined.

CABERNET SAUVIGNON fruit (18,144 kg) grown in northern Virginia was hand-harvested at 23° Brix, and immediately destemmed, crushed, sulfur dioxide (30 mg/L) added, fermentable nitrogen levels were measured and adjusted, and it was divided into treatment lots (as described above). Musts were given a

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cold maceration (cold soak) period of 48 hours at 10°C prior to fermentation, and yeasted (as described above).

Treatments consisted of 1) control, fermentation using a 10,000-L mechanical pigeage, or 2) délestage, conducted in similar size and shape conventional stainless steel fermentation tanks (fill height to diameter ratio, 1:1).

Pigeage consisted of punching three times daily, 10 minutes per punch, with punching consisting of cycles of one minute down and 30 seconds up. Délestage was conducted daily as described above with the following exception: liquid was drained onto a flat tray (0.75 x 1.2 m) with a screen (2.39 mm diameter holes). Fermentations were conducted at an average liquid temperature of 27°C (range 26° to 33°C) and an average cap temperature of 30°C (range 28° to 34°C). Mechanical punching and délestage were conducted for seven days.

Pressing was performed post-dryness (2.0 g/L reducing sugar), 22 days follow-

ing the beginning of fermentation, with a 5,000-L tank press, by allowing free drainage for one hour, followed by pressing to one bar. Free-run and press-run wines were not combined.

Chemical analysis

General fruit, must, and wine chemistries were conducted as described by B. Zoecklein *et al.*⁴³

HPLC analysis was conducted 18 months post-fermentation on selected phenols in finished aged wines described by Price *et al.*¹⁹

Total tannins (catechin equivalents), and the percentage of color from monomeric pigments, small polymeric pigments, and large polymeric pigments was estimated using the procedures of Adams and Harbertson,¹ and Harbertson *et al.*¹¹ The concentration of total glycosides was estimated by the analysis of glycosyl-glucose in thawed samples as described by P.J. Williams *et al.*,⁴¹ and modified by R.S. Whiton

Table V: Effect of mechanical pigeage (P) and délestage (D) on total (TGG) and phenol-free (PFGG) Cabernet Sauvignon glycosides.

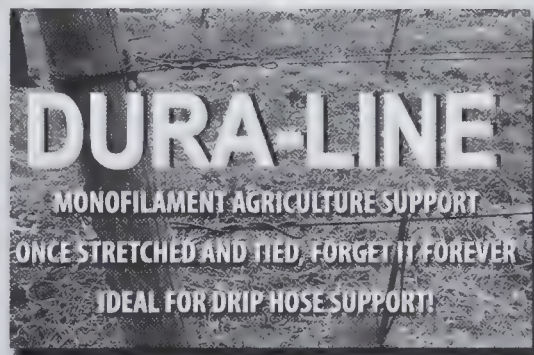
Sample	TGG (μM)		PFGG (μM)	
	P	D	P	D
Post-Cold Soak	986a ^a	662b	189a	98b
Day 10	1441a	1505a	139b	154a
Dejuice	1470a	1470a	113a	94b

^aDifferent letters within rows and assays indicate significant difference ($p \leq 0.05$) of treatment means; $n = 3$.

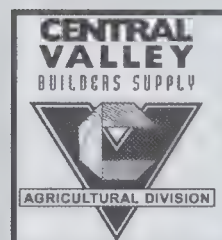
and B.W. Zoecklein.⁴⁰ Analysis of phenol-free glycosides was conducted as described by B. Zoecklein *et al.*⁴⁴

Sensory analysis

Discrimination testing was performed on pooled wine replicates of Merlot and Cabernet Sauvignon, using triangle difference comparison described by M. Meilgaard *et al.*¹⁷ The wines were



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evaluated six to eight months post-fermentation in the Virginia Tech wine sensory laboratory, under controlled conditions that included red lighting to help eliminate color bias.

Panel membership required regular wine consumption (at least one glass per week) and attendance at two informational sessions where the methodology of evaluation was described. Evaluation was done based on olfactory (aroma) and retronasal aroma and mouthfeel (referred to as flavor). Evaluations of aroma and flavor occurred at different times.

Descriptive analysis was performed nine months post-fermentation on non-pooled Cabernet Sauvignon wine treatment replicates, using 11 trained panelists as described by M. Meilgaard *et al.*¹⁷ Panel members evaluated three replications of the two products (pigeage and délestage) six times.

Panelists had one to 10 years experience in descriptive or consensus sensory analysis. A list of descriptors was developed from three pre-evaluation training sessions with standards used for training prepared as reported by B. Zoecklein *et al.*⁴³

Statistical analysis

RESULTS

Merlot

The Merlot fruit averaged 21.5° Brix, 3.7 pH and 5.62 TA for the three years, typical of the region. Berries averaged 1.18 g, with 2.4 seeds, for the three seasons of this study. In years 2 and 3, Merlot fruit monomeric pigments were responsible for an average of 70.5%, SPP 19.7%, and LPP 9.8% of the total color.

By the end of délestage-treated fermentations, an average 25% of seeds had been removed each year. Fermentation

rates were similar among treatments. Total phenols, estimated by the absorbance at 280 nm, increased linearly from crush until dejuicing for both délestage and control wines (Figure I). At day-six (dryness), control lots had a total phenol concentration slightly greater (7.7%) than the délestage (typical of this study).

The percentage of color derived from the monomeric pigments was greater in the fruit than the wine, while the percentage of color from polymeric pigment forms showed the opposite trend.

Merlot délestage and control wines showed slight differences in the percentage of color from the different pigment sources. Délestage wines produced over three seasons averaged 4.8% lower color derived from monomeric pigments, 1.4% higher from SPP, and 4.5% higher color from LPP, compared to control wines (Figure II).

Following fermentation, control and délestage-produced Merlot wines did not differ in alcohol percent (v/v), TA, tartaric, malic, and lactic acids, or pH (Table I).

The total tannin concentration was greater in the control wines upon completion of fermentation each year. The total phenol estimations demonstrated a higher concentration in control wines in two of the three years. Total anthocyanins were higher in the control wines in the two years measured, while absorbance at 420 nm + 540 nm, and 420 nm/520 nm, did not demonstrate consistent patterns between délestage and control wines.

Table II provides the concentration of selected phenolic compounds on aged Merlot determined by HPLC analysis. Significant differences among

treatments were not observed. Catechin and epicatechin concentrations averaged 37 and 26 mg/L for the control and délestage-produced wines, respectively.

Merlot total glycosides increased by day-two, the first day of fermentation (Table III). By the completion of fermentation (dejuicing), the total glycoside concentration had increased by an average of 388% and 296% for the control and délestage wines, respectively.

At dejuicing, the total glycoside concentration was greater in the control wines. Phenol-free glycosides increased by day-two. They generally declined by the end of fermentation, and were in greater concentration in the délestage-produced wines at dejuicing.

Results of discrimination sensory analysis suggested that Merlot wines were perceived to differ in aroma and/or flavor in two of three years.

Cabernet Sauvignon

Cabernet Sauvignon must undergo cold maceration for 48 hours, prior to yeast addition. The effect of fermentation on reducing sugar concentration and percent alcohol (v/v) at various sampling periods was determined by comparing one fermentation vessel each of délestage- and pigeage-produced Cabernet Sauvignon (Figure III).

While the fermentation rates were generally similar between treatments, some differences in the wines were noted. There were no differences in alcohol percent (v/v), TA, pH, or tartaric, malic, or lactic acids, between pigeage and délestage-produced wines (Table IV).

Total tannin, total phenols, and total anthocyanins were greater in pigeage-

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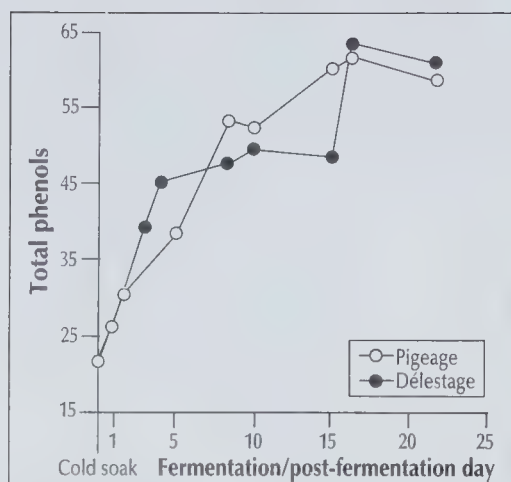


Figure V. Effect of pigeage and délestage on Cabernet Sauvignon — total phenols during cold soak, fermentation, and post-fermentation; n = 3.

produced wines. Differences in absorbance at 420 nm + 520 nm, and 420 nm/520 nm, were noted between délestage and pigeage. Table II provides the concentration of selected phenol compounds on aged Cabernet

Sauvignon. Significant differences among treatments were not observed.

Tannin concentrations remained stable until active fermentation, then increased and were higher in pigeage-produced wines at most sample periods (Figure IV). Total phenols (AU 280) increased for both treatments during pre-fermentation maceration, and significantly during fermentation (Figure V).

At dejuicing, the total phenol concentration in the press wines averaged 14.5% and 9.8% higher than free run for délestage and pigeage wines, respectively (data not shown). At the completion of fermentation, free-run pigeage-produced wines had higher absorbance at 420 nm + 520 nm, and lower 420 nm/520 nm absorbance than délestage wine (Table IV).

During the cold soak period, the percentage of color from monomeric anthocyanins declined dramatically in the juice, then declined or remained constant for the first three days of fermentation (Figure VI).

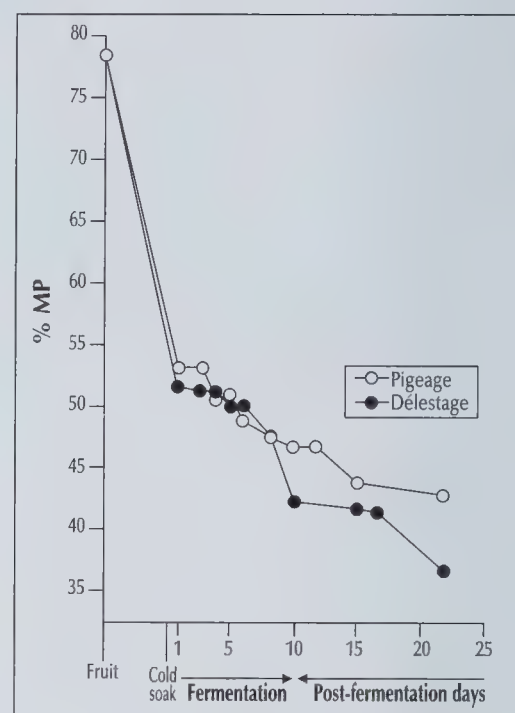


Figure VI. Effect of pigeage and délestage on Cabernet Sauvignon — monomeric pigments (MP) as a percentage of total color during cold soak, fermentation, and post-fermentation; n = 3.

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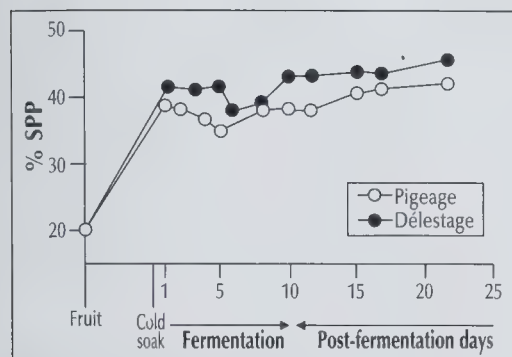


Figure VII. Effect of pignage and délestage on Cabernet Sauvignon — small polymeric pigments (SPP) as a percentage of total color during cold soak, fermentation, and post-fermentation; $n = 3$.

By sampling on day-10 (completion of alcoholic fermentation), the percentage of monomeric pigments had declined for both treatments. At dejuicing, day-22, the percentage of color from monomeric pigments in the pignage free-run wine averaged 33% higher than the délestage wine.

Press wines showed a similar trend (data not shown). The percentage of color from small polymeric pigments increased during the cold soak period, remained or declined during the first five days of fermentation for both treatments, then increased slightly (Figure VII).

The percentage of color from large polymeric pigments increased during cold soak and fermentation for both pignage and délestage treatments, and was slightly higher in the délestage wines at dejuicing (Figure VIII).

Post-fermentation, free-run Cabernet Sauvignon délestage and pignage wines demonstrated 34.6% compared to 43.5% color from monomeric pigments, 53.8% compared to 49.6% color from SPP, and 11.6% compared to 6.9% color from LPP (Table IV), respectively.

Following cold soak, total glycoside concentration was greater in the pignage than délestage tanks by an average of 49% (Table V). Total glycosides increased during fermentation (cold soak to day-10) for

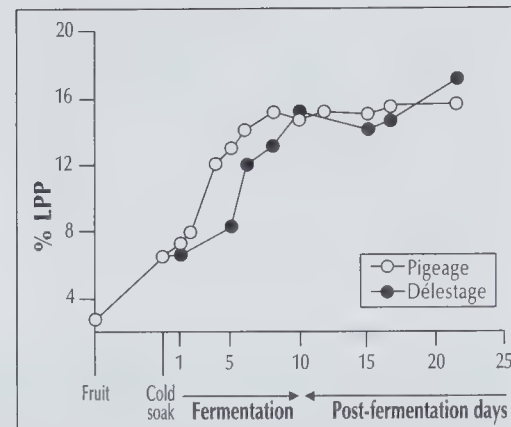


Figure VIII. Effect of pignage and délestage on Cabernet Sauvignon — large polymeric pigments (LPP) as a percentage of total color during cold soak, fermentation, and post-fermentation; $n = 3$.

both treatments. By the completion of fermentation (day-10) and at dejuicing, total glycoside concentrations were similar in pignage and délestage wines. Phenol-free glycosides were in higher concentrations in pignage wines post-cold soak and at dejuicing.

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Discrimination sensory analysis of Cabernet Sauvignon délestage- and pigeage-produced wines indicated differences in aroma and flavor. The principal component analysis (PCA) for aroma indicated variation among treatment replicates that accounted for 59% of the variance (Figure IX). The first

and second principal component analysis of flavor accounted for 63% of the variance (Figure X).

Discussion

A relatively high concentration of extractable seed tannins has been shown to negatively impact wine quality in

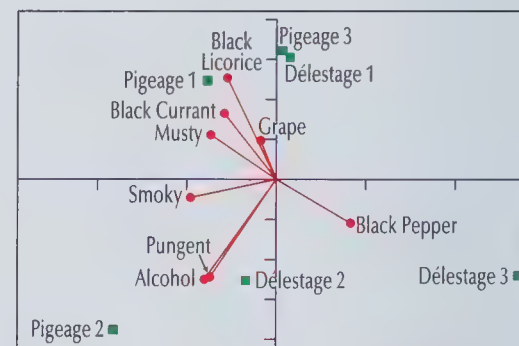


Figure IX. Projection of aroma attributes on principal components 1 and 2 for Cabernet Sauvignon pigeage- and délestage-produced wines; $n=11$.

Virginia and other wine-producing regions. The study was conducted using 1,416 kg lots, and seed removal in conjunction with délestage, to help improve red wine mouthfeel. Due to logistical limitations, including the necessity for replications, wines were not produced by délestage alone, without seed removal.

The majority of the seeds removed (average 25%) were removed in the first few days of fermentation, possibly contributing to the lower total tannin concentration frequently observed in délestage-produced wines. Tannin levels generally remained stable in the must until active fermentation, then increased significantly.

V. Singleton and P. Draper demonstrated that fermentation for 90 hours resulted in extraction of 65% of the available seed tannins, while 180 hours resulted in the extraction of 70%.²⁸ Seed tannins comprise approximately 60% of the total phenols in conventionally-produced red wines,²⁸ with nearly half of the extractable catechins and oligomeric proanthocyanidins in grape seeds transferred into wine.³⁷

V. Kovac *et al.* added seeds during fermentation (6% of the weight of the fruit) and noted a doubling in the concentration of catechins and proanthocyanidins in the fermented wine.¹⁵ For the Merlot wines, about 1.1% of the weight of the fruit was removed as seeds during délestage. A. Bosso *et al.* compared pump over with délestage, using Montepulciano d'Abruzzo, and found that pump over produced wines higher in anthocyanins, polymeric pigments, and tannins.³

In the current study, délestage wines contained a lower tannin concentration

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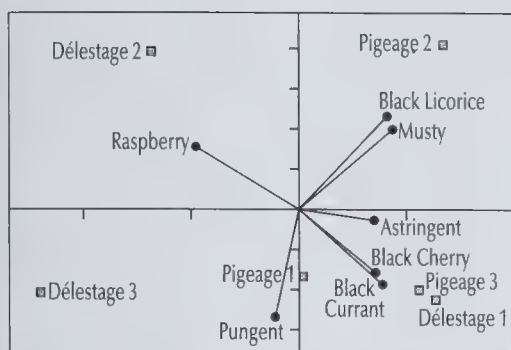


Figure X. Projection of flavor attributes on principal components 1 and 2 for Cabernet Sauvignon pigeage- and délestage-produced wines; n=11.

than controls (manual cap punch down or pigeage), possibly due to limited extraction and seed removal in délestage treatments. However, HPLC analysis of aged wines did not demonstrate statistical differences in selected phenols, including those associated with seeds, such as catechin and epicatechin.

Phenol extraction from seeds is dependent, in part, on the degree of seed oxidation or maturity.⁹ Délestage can allow fermenting juice to percolate through the cap, providing an exchange that may minimize particulate extraction from the cap (Dominique Delteil, 2003, personal communication).

Although not measured in this study, it is possible that délestage reduced the concentration of non-soluble solids, thereby aiding in reduction of total phenols, including skin tannins. Total anthocyanins were frequently in greater concentrations in conventional- and pigeage-produced wines, compared to délestage, possibly suggesting greater extraction.

The higher concentration of total glycosides noted in manual cap-punched Merlot wines may also indicate increased extraction, although there were no differences in total glycosides in the Cabernet Sauvignon produced by pigeage and délestage.

Formation of polymeric pigments is important due to their contribution to color stability. It has been demonstrated that, after only a few years of ageing, the vast majority of color is due to polymeric pigments, with a small concentration of monomeric anthocyanins remaining.³³

Analysis of the fruit demonstrated a relatively high percentage of color

from monomeric pigments compared to LPP, consistent with D. Adams *et al.*,² and J. Harbertson *et al.*¹¹

In the second and third years, the Merlot fruit LPP averaged 9.8% of the color, while corresponding wines averaged 18.5% color from LPP. The increase in percentage of wine color from LPP, com-

pared to the fruit, appeared to parallel a decrease in the percentage of color from monomeric anthocyanins in the wine.

It is generally assumed that formation of polymeric pigments is the result of relatively slow, post-fermentation reactions.³⁴ J. Eglinton *et al.* however, demonstrated that fermenting yeast cells and

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their metabolites are actively involved in condensation reactions with tannins and anthocyanins, suggesting polymeric pigment formation during fermentation.⁶

In this study, it must be noted that the analyses of the percentage of color from MP, SPP, and LPP are estimations. For example, while not impacted by the phenolic matrix,¹¹ monomeric anthocyanins at the pH of the assay are largely in the leuco- or colorless form.

The percentage of Cabernet Sauvignon color from monomeric pigments declined during fermentation for both treatments, by an average of 25%. A. Zimman and A. Waterhouse demonstrated that a significant percentage of the loss of monomeric pigments could be due to association with grape solids.⁴² Therefore, it is possible that a cap management technique that impacts the non-soluble solids level could impact monomeric anthocyanins.

The higher percentage of color from monomeric pigments in pigeage wines

at the end of fermentation may reflect increased fruit extraction. Cabernet Sauvignon color from SPP increased during cold soak, and appeared to increase only slightly from the beginning of fermentation to dejuicing (average 7.8%). The percentage of color from LPP increased during fermentation by approximately 150%.

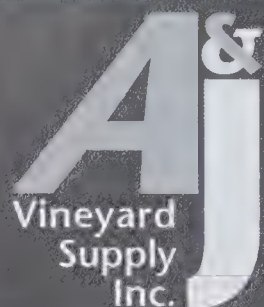
The Cabernet Sauvignon LPP-to-SPP ratio, as percent of color, ranged from 0.11 during cold soak to 0.37 at dejuicing. The SPP would be expected to contain pigment dimers and trimers formed by acetaldehyde crosslinking of anthocyanin and flavan-3-ols.²⁸ The LPP fraction likely contains anthocyanins that have reacted directly with polymeric flavan-3-ols, or by acetaldehyde crosslinks, to form polymeric pigments large enough to precipitate with BSA in the assay.

Phenol-free glycosides were in larger concentration in Merlot, but not Cabernet Sauvignon, délestage-produced wines. The analysis of phenol-

free glycosides includes all but shikimic acid metabolites. This analysis may be a better approximation of the glycosidically-derived aroma/flavor pool than is the total glycosides assay.

Discrimination sensory analysis on pooled treatment replications indicated differences in aroma and flavor among Merlot and Cabernet Sauvignon délestage and control wines. PCA analysis of Cabernet Sauvignon treatment replications demonstrated differences between délestage and pigeage wines, and among replications of the same treatment.

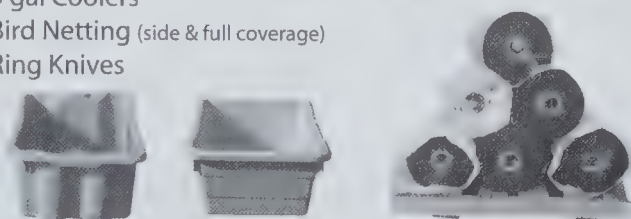
It is evident that délestage wine-1 and pigeage wine-3 have similar aroma and flavor profiles. While treatments were dejuiced each day at the same Brix, individual replicate variation occurred, possibly as a result of the degree of seed removal, pomace drain time, and/or oxygen exposure. With the exception of replicate-1, délestage wines were characterized by pungent black pepper aromas and pungent raspberry flavors.



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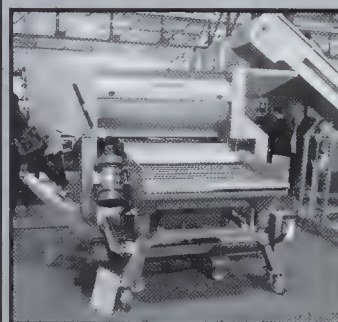


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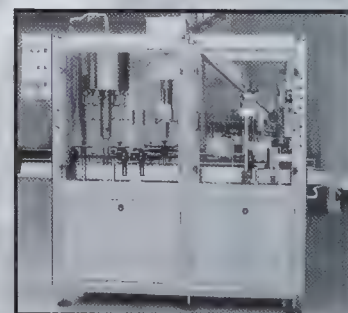


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Conclusion

An important industry goal is to be able to customize maceration methods, predicated on fruit composition and desired outcome. This study evaluated the impact of a cap management technique in conjunction with seed removal.

Given the large variability in fruit composition, the response to a particular maceration technique may be variable. Délestage with partial seed removal appeared to slightly modify the percentage of color derived from monomeric and large polymeric pigments. The result of discriminatory sensory analysis generally suggested differences in aroma and flavor between délestage and control wines.

These differences were charted for the Cabernet Sauvignon, and were variable among replications. These differences may or may not justify the additional effort involved in the utilization of délestage with seed removal as a cap management strategy. ■

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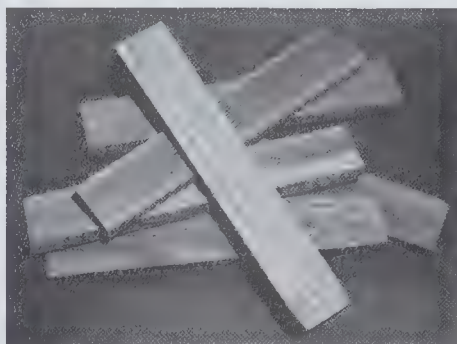
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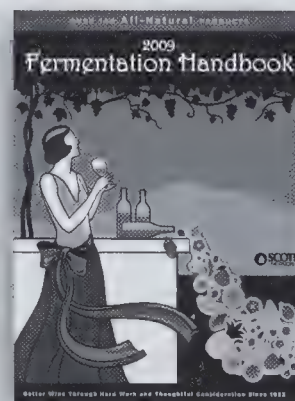
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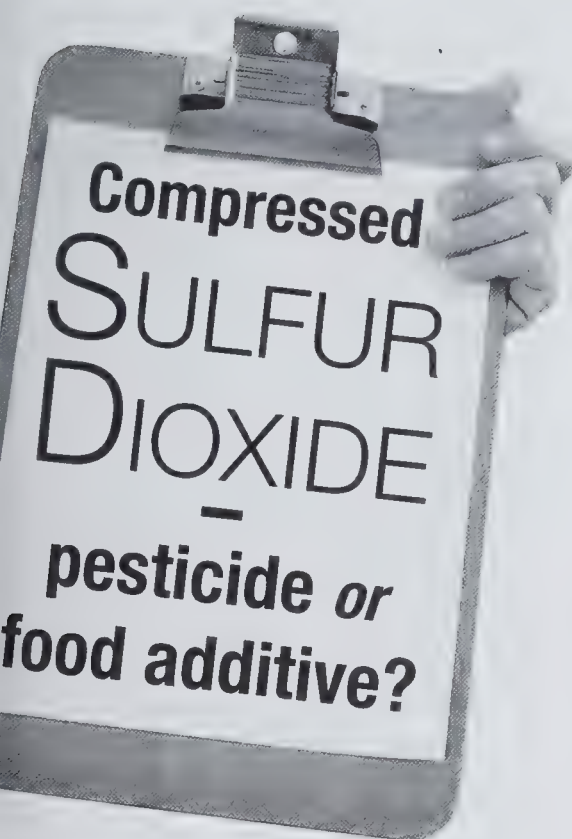
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BY Patricia Howe,
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Compressed sulfur dioxide under the "Fruit Doctor" product name was recently reclassified by the U.S. Environmental Protection Agency (EPA) as a "restricted use pesticide" or RUP (EPA registration #11195-1). It is the only sulfur dioxide product currently approved for use for sanitizing wine barrels and corks.

Non-pesticidal use of sulfur dioxide, as a preservative/antioxidant in wine and juice, is not regulated or controlled by the EPA, and any food grade sulfur dioxide product may be used per Tax & Trade Bureau (TTB) regulations as a wine/juice adjunct. Sulfur dioxide is sold as a pressurized gas, and both gas and liquid exist in the cylinder. A sulfur dioxide cylinder with a siphon tube will dispense liquid SO₂, while the identical style cylinder without a siphon tube will dispense gaseous SO₂. The shoulder of the cylinder has stenciling indicating whether the cylinder will dispense liquid or gas.

Pesticides in the winery?

The EPA defines a pesticide as:

"Any substance or mixture of substances intended to control, destroy, repel, or attract a pest. Any living organism that causes damage or economic loss or transmits or produces disease may be the target pest. Pests can be animals, unwanted plants, or microorganisms."

The term pesticide applies to herbicides, fungicides, and various other substances used to control pests. Thus, by definition, all sanitizers are pesticides, as they are intended to control or destroy microorganisms on food contact surfaces. The EPA defines the term "target pest" as any living organism that causes damage or economic loss, or transmits or produces disease. Pests can be animals (like insects or mice), unwanted plants (weeds), or microorganisms (like plant diseases and viruses).

This is a new concept for the wine industry, where many consider pesticides mainly as sprays used in vineyards to control fungi and insects. We use "pesticide" and "insecticide" interchangeably, but have not traditionally thought of food surface bactericides/ fungicides as pesticides. There are also strong negative associations with the word "pesticide"; few marketing people will be happy to hear that term applied to anything having to do with the winery, although some registered sanitizer/pesticides are approved under the National Organic Program (NOP).

All pesticides/sanitizers must be registered with the EPA and bear an appropriate label. Wineries may use many types of cleaners and sanitizers to keep the facility free of microbial pests. If the primary effect of these compounds is to "control, destroy ... a pest" the EPA will consider that compound a pesticide.

Many of our cleaning compounds (such as soda ash, potassium hydroxide, sodium hydroxide, trisodium phosphate) have some pesticidal side effects, but are not primarily sanitizers. Cleaning compounds with minor sanitizing effects are not considered pesticides by the EPA. Sanitizers such as chlorinated sanitizers, iodophors, quaternary ammonium mixtures, peracetic acid, ozone, etc., that are specifically intended to "control or destroy" microbes, and are registered with the EPA as pesticides.

Some of these sanitizers have secondary effects as cleaners, but if the primary purpose of the compound is to sanitize, the product must be registered with the EPA. Check the labels of your sanitizers and you should find an EPA registration number. The labels should also clearly specify approved uses and legally the products can only be used for those approved uses.

Restricted use pesticides

Some sanitizers present either inherent danger to operators and/or danger to public health if misapplied, which result in EPA registration as a Restricted Use Pesticide (RUP). "Fruit Doctor" compressed sulfur dioxide has been reclassified by the EPA as a RUP due to safety issues for operators and possible risks to the public.

Despite industry input and concerns regarding the effect of an RUP status, it appears that the restricted use label will remain. Kirk Shermer, owner of Snowden Enterprises and supplier of Fruit Doctor SO₂, believes that the EPA's review of sulfur dioxide as a potential inhalation hazard to workers during application without specific personal protective equipment was the primary motivation for the restricted use status.

Not the first time that regulation has been an issue

This is not the first time SO₂ has had restrictions proposed. According to Dr. Sid Siemer (a retired specialist in pesticidal regulation and a former consultant for Snowden Enterprises), there is a long and complicated history of SO₂ registrations.

Prior to the formation of the U.S. EPA, the State of California had one of the strongest set of pesticide regulations in the nation through the California Department of Agriculture. When the federal EPA reached a level equivalent to that of the California state level, they adopted many California registered pesticides at the federal level in what was called the "50,000" series of registrations. SO₂ was one of those products.

These pesticides were to be reevaluated and reregistered by the federal EPA by the late 1980s, but when the delay persisted, the state stepped in for its own

WINEMAKING

reevaluation of SO₂. Art Caputi, former head of the Wine Institute Technical Committee, reminisced that it was all usage of SO₂ in winemaking that was being debated, from crushed fruit to additions at bottling.

However, the wine industry was able to convince the DPR that most of

the usage was intended for the antioxidant function of SO₂. They were unable to make a convincing argument about the addition of SO₂ to crushed fruit, not only because of the overlap in agency jurisdictions but also because of published information showing that there was defi-

nite antimicrobial activity and intention for these additions.

Dr. Siemer recalls that the original proposal asked for approval of three usages: addition of SO₂ to crushed fruit, gassing of wine barrels, and gassing of bagged corks. The EPA eliminated the first usage, leaving just the barrel and cork gassing, which went forward through the process.

Pesticidal and non-pesticidal use of sulfur dioxide in wineries – Regulatory agencies and intended use

American wineries have at least three sets of federal regulations/laws administered by three different departments (Treasury, Health and Human Services, and Environmental Protection). In California, there are comparable state agencies: the Department of Public Health administers wine and food production purity regulations, while the Department of Pesticide Regulation administers pesticide issues. Occupational Health oversees workplace safety.

This multiple nature of administrative agencies is critical to understanding the strange status of SO₂ use in wineries. SO₂ has two very different usages: first, as an **additive** to juice or wine, as specified in 27 Code of Federal Regulations [CFR] (administered through the TTB, with health and safety regulated by OSHA), and second, as a surface **sanitizer** as specified through 21 CFR and therefore as a pesticide per the Federal Insecticide, Fungicide, and Rodenticide Act or FIFRA (administered through the EPA).

Grapes complicate the process, because grapes and crushed grapes overlap multiple federal agencies, including the Food and Drug Administration, USDA (Department of Agriculture), EPA, and their state counterparts. SO₂ treatment of grapes is considered a pesticidal use of SO₂ per the USDA and EPA. But grapes crushed with the intention of being made into wine fall under the TTB, which considers the addition of SO₂ to crushed grapes part of the regulated winemaking process; SO₂ is an approved but regulated additive.



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These overlapping jurisdictions and contradictory regulations are where confusion, misunderstanding, and conflict can arise. Mari Kirrane (TTB wine technical trade advisor), explains that when working with agencies (foreign or domestic) which experience similar conflicts, it is common to develop a "Memorandum of Understanding" (MOU) to allow the various governmental agencies to keep each other informed about conflicting developments. The TTB does have an MOU with the Food and Drug Branch of the Center for Environmental Health, CA Department of Public Health (formerly the CA Department of Health Services, Food and Drug Branch) according to Kirrane.

Perhaps the wine industry should recommend development of a TTB/DPR MOU in proactive anticipation of potential future pesticidal/additive issues.

Thus, depending on the intended use of the sulfur dioxide, the regulating agencies and the applicable rules will change. SO₂ used for the purpose of sanitizing barrels or other materials in a commercial setting is considered a pesticide and is therefore regulated and controlled by the EPA and locally by the California Department of Pesticide Regulation (DPR) and county Agriculture departments. Pesticidal use of SO₂ requires possession of a Qualified Applicator Certificate (QAC).

The addition of SO₂ to juice or wine as a preservative is considered an allowed but regulated and controlled use through the TTB. Non-pesticidal use (that is, use as a food additive) is NOT controlled by the DPR. This "wine additive" version of sulfur dioxide, even if it comes from the same supplier as the sulfur dioxide used as a sanitizer, is not registered as a pesticide, because it isn't being used as one.

Protection of employees and safe use of SO₂ under this application is regulated in California by the Department of Environmental and Occupational Disease, Center for Chronic Disease Prevention and Health Promotion, Department of Public Health.

The intended use of the chemical, not the chemical itself, determines its status, and thus who controls it and which laws apply.



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• You cannot use the Fruit Doctor gaseous SO₂ as a wine additive, even if you have a QAC.

• You cannot use a different gaseous SO₂ cylinder for sanitizing corks or barrels, because, currently, only the Fruit Doctor is registered for that purpose.

The best argument I have seen against referring to barrel gassing as "pesticidal" use of SO₂ relies on the rather tenuous legal definition of barrels as "non-taxable food additives" in California. This argument has not gained any traction.

Pesticide Residue or Food Additive?

The EPA sets limits on how much pesticide residue can be detected. What happens if pesticidal SO₂ from treating empty barrels ends up in the finished wine? How will the DPR enforce these limits? Rachel Kubiak (DPR ombudsperson), explains: "To the state of California, this is a 'non-issue,' as the food additive is indistinguishable from

the pesticide residue and it would be impossible to differentiate the two."

Qualified applicators only

Registration of the Fruit Doctor gaseous sulfur dioxide as a federal RUP for use in sanitizing barrels and corks caught the California DPR and the California wine industry a little by surprise. All federally restricted-use pesticides may only be purchased and used by persons with a Qualified Applicators Certificate (QAC — the minimum requirement, which applies to a winery situation) or Qualified Applicators License (QAL — usually a requirement for an independent pesticide applicator).

The DPR administers the QAC and QAL testing, and works through the County Agriculture Commissioners' offices for compliance and enforcement. Once the DPR learned of the use of sulfur dioxide for sanitizing purposes, they responded by coordinating with counties to extend information to

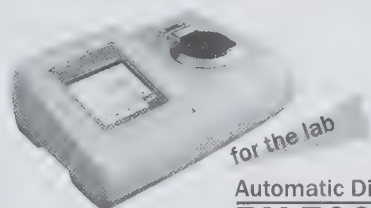
regional wine industries through mailings, websites, and at local meetings.

Unfortunately, most California winery employees first learned of the new regulations when they went to refill the sulfur dioxide gas order at the local supplier and learned that they were unable to purchase what they needed. They learned that to purchase and use gaseous SO₂ one needed an operator identification number and one winery employee has to possess a QAC.

Obtaining a Qualified Applicator Certificate in California

The Qualified Applicator Certificate shows that the individual has taken and passed two tests. One test, "Laws and Regulations," is a comprehensive overview of pesticide laws and regulations. The material covered in this test can be downloaded and studied via the California Department of Pesticide Registration webpage at www.cdpr.ca.gov/docs/license/pubs/L&R_Study_Guide_2001.

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The study guide is 132 pages long and covers all aspects of pesticide regulations.

The other test is dependent on the applicant's occupation and application, described by a specific pest control category or subcategory. These categories are referred to by letter and/or by specialization. Someone wishing to obtain a QAC for sulfur dioxide use must take the test in subcategory P, "Microbial Pest Control."

Applicants must pass both tests at 70% or better. Associated fees are about \$140.

Initial testing for winery employees for sulfur dioxide use in California took place in February and March of 2009. More than 110 winery employees participated in the Napa County test held at the Napa Fairgrounds. They had an advantage over those who have not yet taken the tests: their subcategory P test was specific to SO₂ use,

using the EPA label and MSDS information in an open-book format.

The California DPR is working on expanding the Microbial Pest Control test for future applicants. Additional test dates can be found at the DPR website or through a local California County Agricultural Commissioner's office. Future dates in Sacramento include August 25, 26, 27, 28 and October 20, 21, 22, 23.

P & L Marketing Inc. (Visalia, CA, tel: 559/733-5047, pesticideguides.com), offers "Fast Track Pesticide Applicator Exam Prep Classes" to help ensure that employees pass the first time and save on time, travel, and expense. The Pesticide Applicators Professional Association (PAPA) also offers courses at locations throughout the state. Continuing Education classes are on-line (a verification quiz).

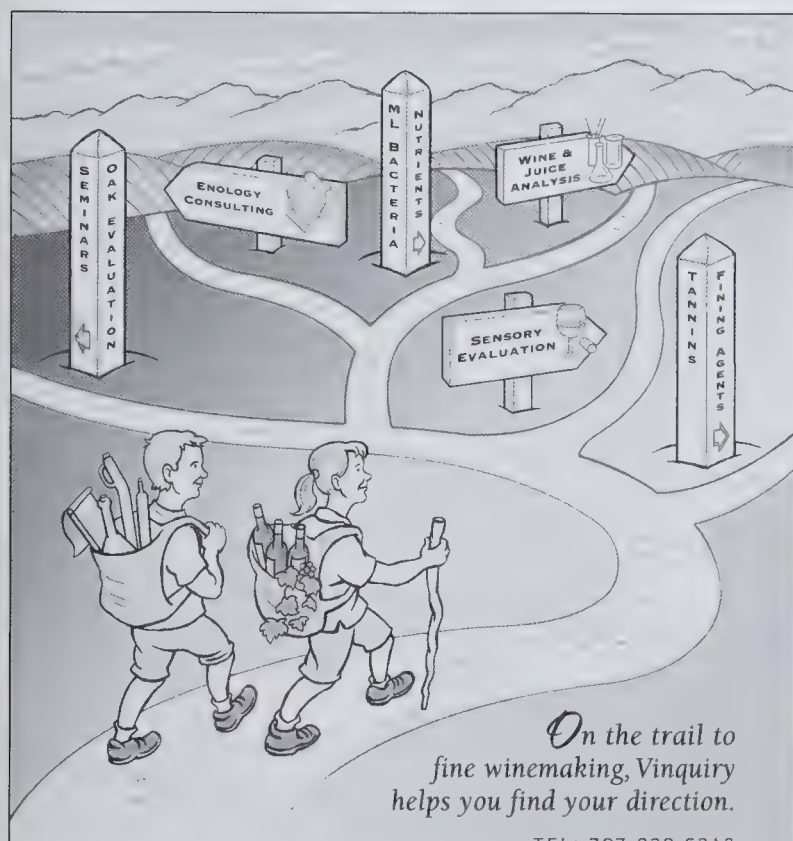
Qualified Applicators must participate in ongoing education and accumulate Pesticide Applicators Credits. It is

currently unclear which programs will be applicable for QAC certification in subcategory P. Napa County is working with local suppliers to develop programs.

Monthly reporting

The basic requirement for using an RUP is monthly reporting of usage to the local county agriculture department. For Fruit Doctor use, sulfur dioxide cylinders must be weighed and the appropriate form filed monthly. Theoretically, this allows regional tracking of these potential public health hazards.

Local County Agricultural Commissioners are responsible for enforcement of DPR regulations, but prefer to work as educators first. According to Humberto Izquierdo (Napa County Ag. Commissioner's office), fines for pesticide violations in Napa County are rare. If wineries have questions or concerns about their compliance (or lack of), he encourages them to call and get help or clarification. The rarely administered fines are due



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to deliberate, repeated, and egregious violations, not the occasional misunderstanding or late filing of paperwork.

California Restricted Material – It could be worse

In California, the DPR can restrict materials deemed by their internal process to be of additional concern to the state. The listing of any winery sanitizer/pesticide as a California Restricted Material (CRM) would be an additional regulatory step for winery compliance personnel.

Use of a CRM requires obtaining an annual permit from the appropriate County Agricultural Commissioner (who can deny permits for various reasons) and then filing a "Notice of Intent to Apply a Restricted Material (NOI) for each date of application." California does not list the Fruit Doctor sulfur dioxide as a CRM.

What about other states?

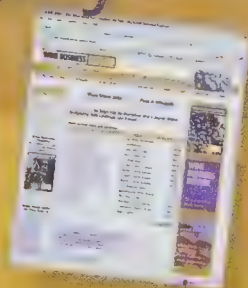
Extension and/or university enologists in Washington, Oregon, Texas,

Indiana, and New York have not yet heard any word or sign that any changes may be coming in the ability of industry members to purchase pesticidal SO₂. The Federal EPA guidelines are quite clear: use of SO₂ as a sanitizer must be with registered products, and, to date, Fruit Doctor is the only gaseous SO₂ approved for this use — and currently **it is only registered and approved for use in California.**

Kirk Shermer (Snowden Enterprises, "Fruit Doctor" supplier), is unaware of any demand for gaseous SO₂ for barrel or cork sanitation outside of California. When asked about the procedure for supplying other states, he explains that there can be significant expense in filing with each state's department of agriculture, and paperwork continues for years with or without sales within the state.

If wineries in other states are using gaseous SO₂ and need access to a registered use product, they will need to

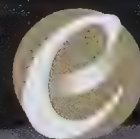
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contact Snowden Enterprises to discuss starting the registration process for their state (559/237-5546) or discuss the issue with their local SO₂ supplier.

According to Terri Siemer-Aal (Reedley, CA regulatory consultant), two other SO₂ producers (Seaco Technologies, Inc. and Teck Cominco American, Inc.) obtained "me-too" federal EPA registration of their SO₂ compressed gas products. A Teck Cominco American spokesman (Spokane, WA) states that their product has no registrations for wine barrels and corks in any state.

What about other sanitizers?

Two issues come up frequently in discussions about winery sanitizer/pesticide registration. The first is finding an alternative to sulfur dioxide gas that could work as a good empty barrel treatment. There is no indication that traditional sulfur wicks have been registered by the EPA.

The second, and more disturbing, issue is that other pesticides and sanitiz-

ers used in winery applications are being evaluated by the EPA for possible reclassification as restricted pesticides. Even worse, some have never been registered for pesticidal use, despite their common use as sanitizers in wineries.

Ozone is an interesting case. Ozone can be dangerous to operators, but the generators produce the compound from relatively harmless substances. These ozonators may be considered "devices." A mousetrap is a "device" that acts as a pesticide. An ozone generator may be the EPA equivalent of a mousetrap, and mousetraps do not need EPA pesticide registration.

Chlorine dioxide, an effective sanitizer used in many breweries, is a slightly different case — the chlorine dioxide is generated from two more dangerous chemicals.

Other forms of SO₂ are a concern. The few sodium metabisulfite sanitizers registered on the EPA website (none using potassium metabisulfite), are not regis-

tered for use in wineries. Many facilities use a potassium metabisulfite-citric acid solution for surface sanitizing.

Many wineries use a food grade beverage ethanol (at 70%) to sanitize various food contact surfaces (sample valves, bungs, filler valves, etc.) but there is no pure ethanol product registered as a sanitizer.

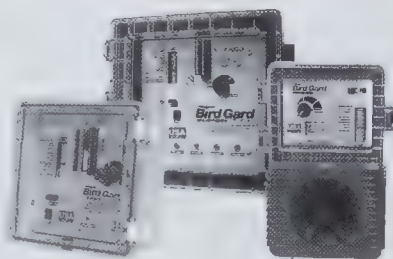
Unfortunately, the federal EPA website database does not appear to be current and may therefore be an unreliable source of the status of any sanitizer or pesticide. For example, the Federal EPA site still lists "The Fruit Doctor" as "unrestricted." Rachel Kubiak's (California DPR ombudsperson) advice is to check the label on the product, which should be the most accurate and up-to-date source of information.

As long as these inconsistencies in registration and licensing requirements remain, winery operators need to stay aware of changes that may affect their use of sanitizing products. ■

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2009 UPDATE

ENERGY
MANAGEMENT

Energy-efficiency projects at California wineries and vineyards have increased fivefold from 2005 to 2009, reports the Wine Institute's California Sustainable Winegrowing Alliance (CSWA). CSWA began tracking winery projects in 2005 when it partnered with Pacific Gas & Electric Company (PG&E) to cosponsor energy efficiency workshops for the wine industry.

413 energy-efficiency projects at wineries have earned \$6.8 million in PG&E rebates/incentives, and saved more than 63 million kilowatt-hours (kWh) of electrical energy, and 458,574 gas therms. PG&E reported a steep rise in rebate/incentive filings and payouts, from 12 incentive checks to wineries in 2007, to 59 in 2008.

"Energy efficiency is one of 14 sustainable winegrowing areas in the CSWA program," says Robert Koch, Wine Institute President and CEO. "Since CSWA's establishment six years ago, 1,500 wineries and vineyards have participated in the sustainable winegrowing program, representing 60% of California's wine production and winegrape acreage."

"It is not surprising that there is such widespread adoption of energy-efficiency practices, because the wine industry is dominated by families and businesses committed to the land and their local communities," notes Karen Ross, President of the California Association of Winegrape Growers.

CSWA and PG&E have conducted 25 energy management workshops attended by 750 wine industry members from around the state, and have an ongoing workshop schedule.

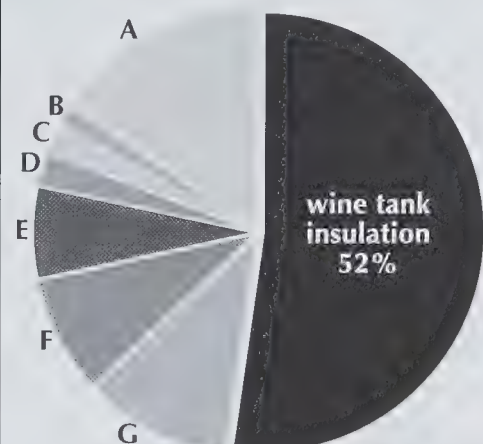
The number of solar projects in the wine industry has increased, with more than 100 California wineries now

using solar PV systems to offset electrical demand. CSWA reports 49 solar projects are currently underway at wineries/vineyards. ■

Resources and rebate programs for winery and vineyard energy-efficiency and solar projects:

- Energy audits, rebates and incentives: <http://www.pge.com/mybusiness/energy/savingsrebates/incentivesbyindustry/agriculture/>
- Solar and renewable energy installations (the "Self-Generation Incentive" program): <http://www.pge.com/mybusiness/energy/savingsrebates/selfgenerationincentive/>

Energy efficiency projects completed at California wineries



A: refrigeration 16% E: whole building/multiple measures 7%
B: miscellaneous 1% F: process load 9%
C: irrigation 2% G: lighting 11%
D: wastewater 2%

- Demand response programs: <http://www.pge.com/mybusiness/energysavingsrebates/demandresponse/>
- CSWA links and workshops: <http://www.wineinstitute.org/initiatives/sustainablewinegrowing>

Completed winery projects as of Dec, 2008*

Project type	kWh saved	Therms saved	Incentives paid
wine tank insulation	33,098,152	0	\$3,854,051
lighting	6,822,420	-1,438	\$762,368
process load	5,414,266	449,461	\$532,175
whole building / multiple measures	4,308,541	1,835	\$509,366
wastewater	1,440,017	4,206	\$137,026
irrigation	1,401,149	0	\$115,619
misc	925,841	4,267	\$92,959
refrigeration	9,855,912	244	\$828,628
	63,266,298	458,575	\$6,832,192

Total number of projects: 413

*data from PG&E

UPCOMING CSWA/PG&E WORKSHOPS FOR WINERIES

July 23: Climate Protection and Energy Efficiency Workshop. First in a new series of workshops on comprehending potential carbon impacts from operations will be held in Sonoma County (location to be determined) on July 23; additional dates/locations will be offered in 2009.

August 4-5: Eco-winegrowing symposium, Brutocao Cellars, Hopland. Workshops will include water savings, dry farming, bio-control of pests, reduced sulfur use, increasing organic vineyard resilience, carbon sequestration, results of Mendocino carbon study, green certifications and regulations, green politics and practices, green marketing to consumers.

Visit www.sustainablewinegrowing.org/workshopcalendar.php for details.

CONTROLLING HEAT STRESS RISKS

BY Howard Rosenberg,
University of California, Berkeley

High temperatures and the rush of summer activity increase risks of heat-related problems. Heat can cause plenty of harm short of fatality, and not only in warm-weather seasons. It is a fact of life in vineyards across the nation.

In California, grape growers and workers face legal as well as physical heat-related challenges. A state regulation designed to reduce the risks of heat illness in outdoor workplaces took effect in mid-summer 2006, adding to employers' responsibilities for safe operation.

The rule obligates all covered employers, including vineyard operators, to take specific measures to help workers control heat stress and get timely care for heat-related illness. (See Basics section, page 90). It carries significant penalties for noncompliance.

During the 2009 mid-May heat wave, the California Division of Occupational Safety and Health (Cal/OSHA) shut down eight farm labor contractors in the central and southern valleys for violations of the heat illness prevention regulation. Charges included not providing adequate drinking water or shade for employees working in very high temperatures.

Cal/OSHA can stop operations with an Order to Prohibit Use (OPU) when it finds workers exposed to an imminent hazard, until it is satisfied that the employer is ready to safeguard them. The first three OPUs in heat-related cases were issued in 2008.

Regardless of legal mandates, it pays to help workers minimize heat stress impacts. But following rules, keeping the Igloos® full, having shade nearby, and reciting a litany of advice

to drink lots of water, beware of stress symptoms, and rest when necessary goes only so far.

How heat hurts

Humans can perform work under a wide range of conditions as long as their internal organs and biochemical reactions are doing well, which depends on their temperature being within a narrow range around 98.6°F. When bodies get too cool or warm, natural processes that add or release heat kick in to restore the norm.

Although "feeling hot" causes discomfort and distraction, the cooling process often gives rise to greater dangers. While heat stress tends to be more of a problem when the weather is hot, high ambient temperature is not its primary cause.

Heat from solar radiation and surrounding air can affect vineyard workers but most of the heat that they have to cope with is produced within their own bodies. The body's metabolism generates some heat even at rest. When it speeds up during physical work, its yield of heat as a by-product also increases.

This heat raises internal temperature, threatens normal functioning, and triggers dissipation mechanisms. Internally generated heat is more difficult to release where the air is hot, humid, or still. Both retained heat and the body's attempts to shed it can eventually cause symptoms recognized as a "heat illness" that impairs physical or mental activity, reduces performance, increases risk of accidents, and endangers life. Heat stroke, the most serious such illness, is a medical emergency.

Although less critical ailments — heat exhaustion, heat syncope (fainting), heat cramps, and heat rash — are not immediately life-threatening, they reduce well-being and performance and can progress to heat stroke if not treated. The **sidebar** describes common symptoms of and treatment guidelines for these illnesses.

Even minor effects of excess body heat and the loss of fluid through sweating may cause damage.

Subtle discomfort, weakness, blurred vision, slowed reactions, diverted attention, lapses in concentration or judgment, reduced coordination, and irritability add to chances of workers hurting themselves and also translate

HEAT ILLNESS SYMPTOMS and FIRST AID

HEAT RASH — Acute skin inflammation and clogging of sweat ducts. Regarded as the least severe of heat illnesses. Though it usually causes only temporary discomfort, it can lead to a bacterial infection that shuts down the function of sweat glands. **Rx:** Cleanse the affected area thoroughly and dry completely. A mild steroid cream, calamine, or other soothing lotion may help relieve discomfort and infection.

HEAT SYNCOPE — Loss of consciousness, generally sudden, due to lack of sufficient blood and oxygen to the brain. Greatest danger is secondary injury from a slip or fall. Most likely to affect people not yet acclimatized to work in hot environments. Heat stress can cause syncope by diverting blood to extremities or lower body at the expense of the brain. **Rx:** Rest, ventilate, and drink plenty of water or electrolyte fluids.

HEAT CRAMPS — Painful, involuntary muscle contractions — most common in calves, thighs, arms, and abdomen — heavy sweating, and thirst. Often extremely uncomfortable and can be completely disabling. Typically occur during or after hard work and are induced by electrolyte deficiencies that result from extended

periods of intense sweating. **Rx:** Rest and drink plenty of water or electrolyte fluids.

HEAT EXHAUSTION — Symptoms include fatigue, headache, dizziness, muscle weakness, nausea, and chills, tingling of hands or feet, confusion, loss of coordination, fainting, and collapse. Occurs during exertion and results from dehydration, lack of acclimatization, reduction of blood in circulation, strain on circulatory system, and reduced flow of blood to the brain. **Rx:** Rest in the shade or a cool place. Drink plenty of water (preferred) or electrolyte fluids.

HEAT STROKE — The most extreme consequence of uncontrolled heat stress, a medical emergency that can develop suddenly from an untreated condition of heat exhaustion. Skin is hot and dry, body is typically hotter than 104°F and no longer able to cool itself, and the mind is confused, delirious, or convulsive. Brain damage and death may result. **Rx:** Summon aid. Immediately move to the coolest place available, loosen clothing, fan and douse or spray the body continuously with a cool liquid. Begin to replenish body fluids by drinking. Get medical attention and/or transport to a medical facility as soon as possible.

Continued on page 90

Using directed breeding to improve yeast's temperature tolerance

BY Charlotte Gourraud,¹

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Scientists around the world are constantly searching for improvements in winemaking methods and tools. One of the latest innovations to improve yeast strains is the directed breeding technique.

The basic technology has been used for many years but new innovations in technology and genetics have allowed yeast scientists much more control in developing new strains. Below, we have used an example of a specific development project that was focused on improving temperature and ethanol tolerance characteristics for a red wine yeast strain.

Temperature is a key factor in the fermentation of must; its effect on yeast metabolism, aroma profile, color extraction in red wines, etc. has been examined in the literature.² Some yeast have better resistance to high temperatures. S. Rainieri demonstrated that heat-tolerance of yeast resulted from the interaction of several genes, making it extremely complicated to obtain heat-tolerant strains that also have other desirable traits for winemaking which are also polygenic, such as ethanol tolerance, low volatile acidity production, and appropriate aromatic contribution.¹

Breeding techniques, more specifically a series of backcrosses, may be used to overcome this difficulty. Though we typically think of yeast as asexual, they can be coaxed to produce spores that can then be crossed sexually — a method analogous to directed breeding in agriculture.

This directed breeding approach, consists of repeated backcrosses to obtain a specific trait that gives an individual host an identified advantage without using genetic modification techniques.

The research presented here involved a directed breeding program, based on phenotype observations, to develop specific improvements in an original commercial yeast strain, making it more heat-tolerant, and reliably able to complete fermentation.

Developing the desired outcome by backcrossing — The first-generation hybrid (H1) was produced by crossing spores from existing commercial strains A (Zymaflore F10[®]) and B, via micro-manipulation. The next-generation hybrids, H2, H3, and H4, were obtained by crossing spores from the parent A with spores from the H1, H2, and H3 clones, respectively, selected by phenotype. In the end, the fourth generation had over 93% of its genome in common with the initial strain (Figure I).

Impact of temperature on fermentation completion for nine commercial strains — To assess the impact of temperature on red wine fermentation, we

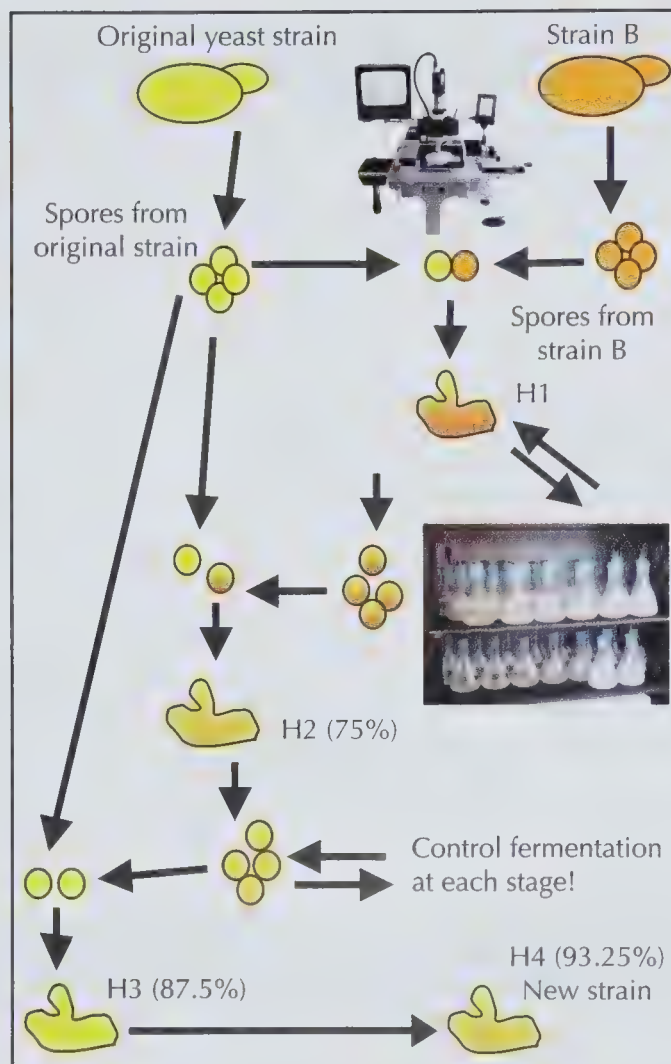


Figure 1: Principle of directed breeding used to produce fourth-generation, heat-tolerant hybrid yeast.

measured the capacity of nine commercial strains commonly used in red winemaking, to isothermally ferment a synthetic medium at (77°F) and (82°F) (Table I). This data demonstrates that over 50% of industrial winemaking strains are likely to stop fermenting in a must at 82°F.

Most of the strains used for red wine are, therefore, heat-sensitive and demonstrates that excessively high (above 86°F) temperatures should be avoided, especially during the cell division phase and at the end of alcoholic fermentation. This corroborates the empirical experience of winemakers, who maintain a reasonable (below 82°F) temperature during the fermentation of red must.³

Backcross stages to bring a “temperature resistant” trait into a “temperature sensitive” strain — The aim was to enhance the performance of a heat-sen-

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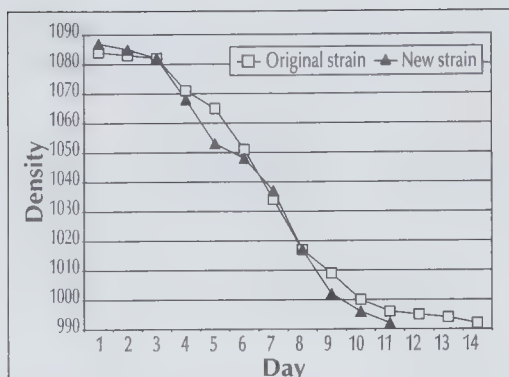


Figure II: Comparison of the alcoholic fermentation kinetics of the original and new yeast strains (first trial). Strains' fingerprinting was confirmed by PCR.

sitive commercial strain "TS" (original strain A), while conserving its useful fermentation and organoleptic characteristics.

The "TR" phenotype of 10 progeny (hybrids) was checked after each crossing stage by fermentation at 82°F. The best strain was then retained for future crossings with strain-A. In each gener-

ation, observations confirmed that the phenotype of the hybrid had been enhanced as compared to the initial A-strain.

Sterol deficiency and high temperature were limiting factors for A-strain. The fourth-generation X-strain showed enhanced resistance to these factors under all fermentation conditions tested. A synergy was also observed between sterol deficiency and high temperature.

Conclusions on directed breeding

The directed breeding technique consists of crossing two strains, selecting precise characteristic(s) to be retained from each one. This technological breakthrough, applied to winemaking for the first time by SARCO laboratories and the enology laboratory at the Faculty d'Enologie de Bordeaux, provides many opportunities for significant development of yeast strain applications. It is impor-

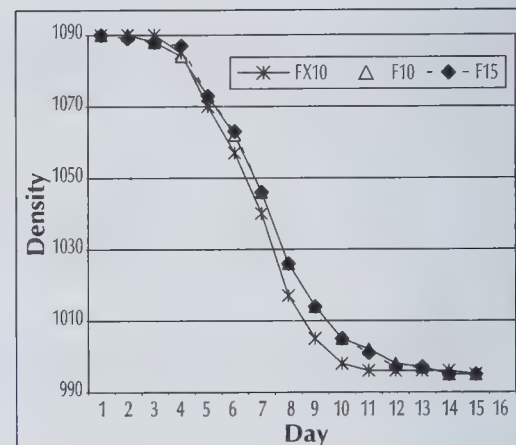
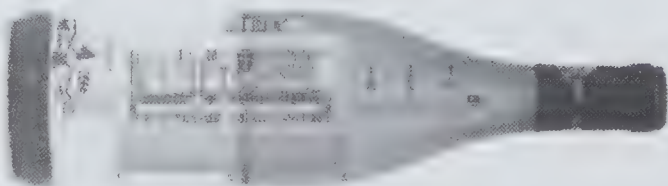


Figure III: Kinetics of alcoholic fermentation (second trial). Strains' fingerprinting confirmed by PCR.

tant to note that neither directed breeding, nor simple breeding, involve genetic modification techniques.

The most important application of directed breeding is to adapt commercial yeast strains to new winemaking conditions or techniques. This was the aim with the A-strain. It was crossed

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with a heat-resistant parent with excellent fermentation capabilities, and then the "best" strain from each generation was backcrossed with the initial strain, to obtain a strain with over 93% of its genome, thus retaining all its organoleptic characteristics.

This new strain has been tested under commercial winemaking conditions for large-volume fermentation in several countries, to confirm two key points: that it had better fermentation capacities than the original and retained all main characteristics of the parent strain, particularly in terms of mouthfeel. These aspects are discussed below.

Winemaking trial with new and original strains

The trial consisted of fermenting 2007 Merlot grapes in Bordeaux in 200hL tanks. Two parallel tests were run, using identical fermentation parameters (skin contact, extraction, tem-

Table I: Impact of temperature on nine commercial red winemaking strains.
These data represent the means of two independent experiments.
Strain G is the new heat-tolerant strain.

Strains	S+A+ medium at 24°C				S+A+ medium at 28°C			
	AF time	Red. sugars	Vmax	Latency phase	AF time	Red. sugars	Vmax	Latency phase
	(h)	(g.L ⁻¹)	(g. L ⁻¹ h ⁻¹)	(h)	(h)	(g.L ⁻¹)	(g. L ⁻¹ h ⁻¹)	(h)
A	249	1.0	1.52	15	SF	9.2	1.73	10.3
B	158	1.0	1.46	17.5	175	1.0	1.76	11.3
C	287	0.6	1.53	12.7	332	1.8	1.56	12.7
D	307	0.4	1.38	13.3	410	0.8	1.49	14.3
E	378	0.9	1.22	13.0	SF	12.9	1.64	12.3
F	417	1.8	1.43	13.3	SF	32.8	1.99	11.7
G	343	0.7	1.38	44.7	SF	32.8	1.92	35.7
H	264	0.4	1.42	13.0	264	1.2	1.55	13.3
I	SF	8.6	1.23	18.7	SF	48.0	1.41	13.7

SF= Stuck Fermentation

perature, aeration, nutrients, etc.). The only difference was the yeast strain: the first tank was inoculated with the new yeast and the second with the original strain.

Enzymes (3 g/100 kg [30 ppm]) were added to the grapes and the must was inoculated with 20 g/hL (200 ppm) yeast the day after tanking. The temperature was maintained at 26°C

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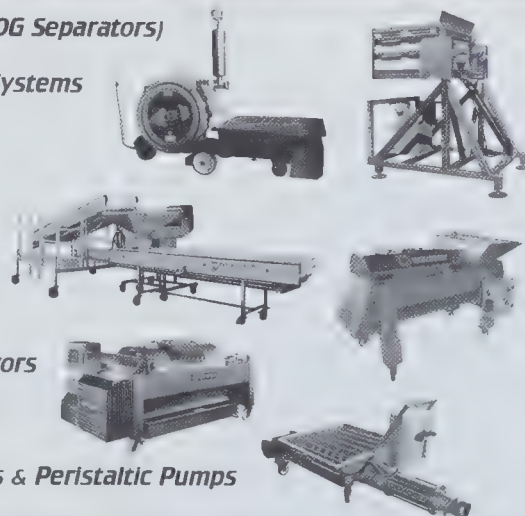
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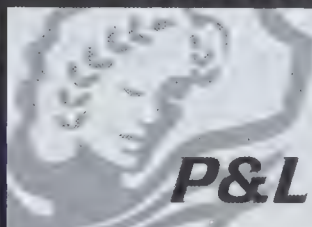
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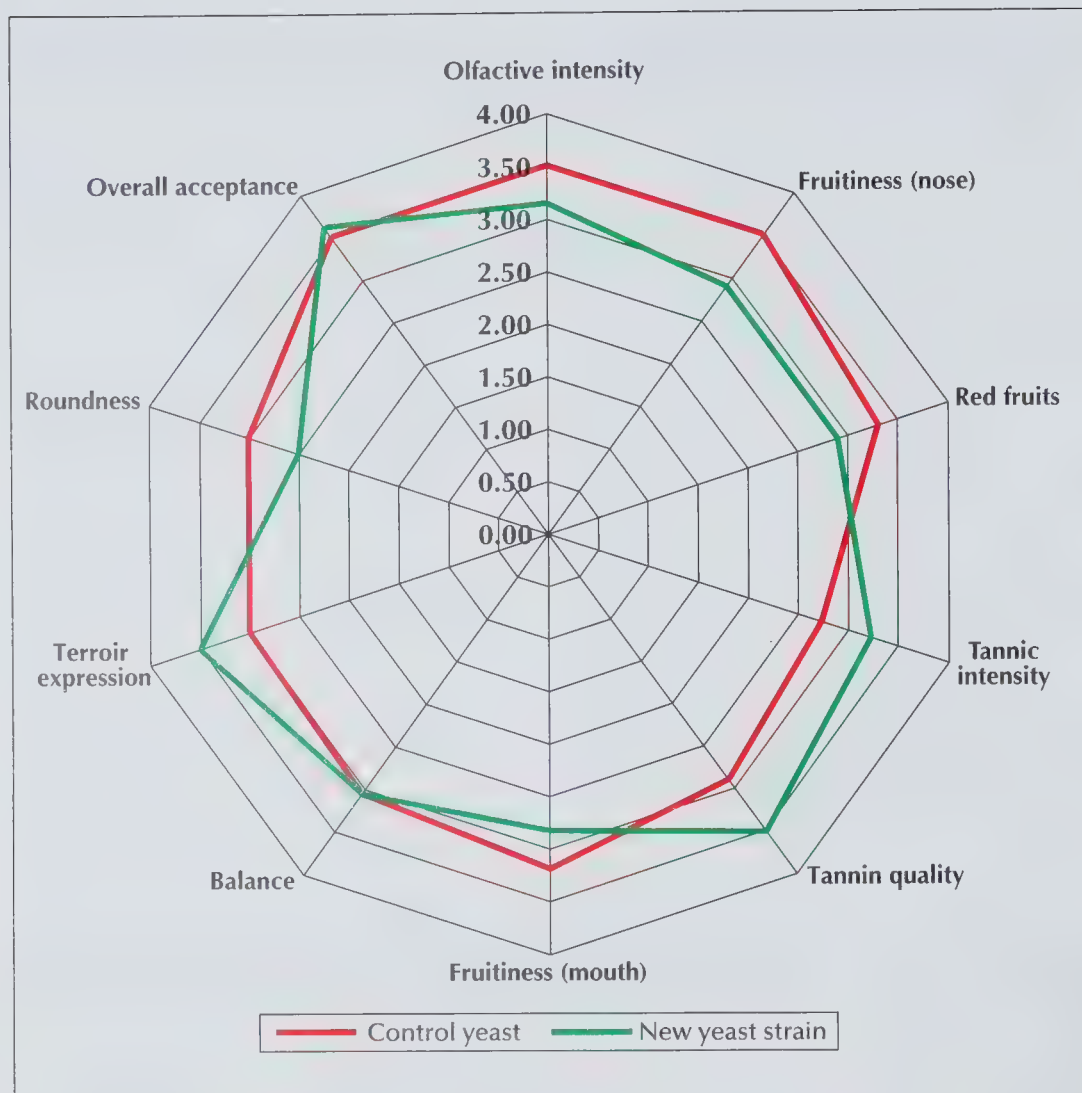


Figure IV: Comparative descriptive tasting of wines in second trial made with new strain and control strain.

(79°F) throughout alcoholic fermentation. Development of the yeast strains inoculated in both tanks was confirmed by genetic analysis (PCR), halfway through fermentation.

A one-day difference was noted in the latency phase for yeast-A (possibly for adapting to the difficult conditions), but, both graphs had the same slope, and same fermentation rate during the first stage (Figure IV). However, the kinetics at the end of fermentation were markedly different: fermentation with the new yeast ended very cleanly, whereas it slowed down considerably with the original strain once the density dropped below 997.

The wines were analyzed at the end of alcoholic fermentation, after 10 days post-fermentation skin contact (Table II). There were no significant differences between analysis results for the two wines.

This confirmed enhanced performance of the new yeast compared to the original strain under slightly limiting conditions (13% v/v alcohol). Under slightly tougher conditions, fermentation with the original strain would probably have stopped prematurely.

Organoleptic characteristics of new and original strains

The original yeast is known for its specific organoleptic characteristics: wines

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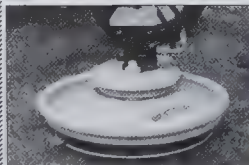
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Table II: Standard analyses of the wines in first trial after alcoholic fermentation.

Wine	Original yeast strain	New yeast strain
Alcohol (% v/v) (+/-0.19)	13	13
Reducing sugars (g/L) (+/-0.44)	1	1
Total acidity (g/L H ₂ SO ₄) (+/-0.15)	4.66	5.11
Malic acid (g/L)	4.19	4.35
Volatile acidity (g/L H ₂ SO ₄) (+/-0.04)	0.25	0.27
pH (+/-0.05)	3.71	3.63
Free SO ₂ (mg/L) (+/-3.8)	0	0
Total SO ₂ (mg/L) (+/-12.5)	42	43

fermented with this strain are elegant, with good structure, and silky tannins (low reactivity), and retain all their typical varietal aromas. The new yeast was

Table III: Standard analyses of the wines in second trial after alcoholic fermentation and malolactic fermentation (phenolic compounds).

Wine	New yeast strain	Original yeast strain	Control strain
Alcohol (% v/v) (+/-0.19)	12.30	12.20	12.20
Reducing sugars (g/L) (+/-0.44)	1.1	1.7	1.3
Volatile acidity (g/L H ₂ SO ₄) (+/-0.04)	0.13	0.14	0.14
Modified Color Intensity	7.29	7.53	7.33
OD 280	59	61	60
Tannins (g/L)	3.3	3.5	3.4
Gelatin index	49	48	58
HCl index	15.9	16.5	16.4

designed to exhibit the same aptitude for making wines suitable for ageing.

In order to compare characteristics of these two strains, a trial was performed under non-limiting conditions, so that the original yeast could ferment completely and express its full potential. Cabernet Sauvignon grapes (2007), from Bordeaux were fermented in 200L tanks.

The must analysis results follows: sugars 198 g/L, potential alcohol 11.4% v/v, TA 2.80 g/L H₂SO₄ (4.44 g/L tartaric acid), pH 3.60, malic acid 2.80 g/L, available nitrogen 63 mg/L. The nitrogen deficiency was corrected by adding a DAP-thiamine nutrient twice, once when the yeast was added, and again when fermentation was one-third completed, and the

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Table IV: Standard analyses of the finished wines in third trial after malolactic fermentation.

Wine	New yeast strain	Control
Alcohol (% v/v) (+/-0.19)	14.60	14.85
Reducing sugars (g/L) (+/-0.44)	1.7	1.9
Total acidity) (g/L H ₂ SO ₄) (+/-0.15)	3.41	3.45
Volatile acidity (g/L H ₂ SO ₄) (+/-0.04)	0.33	0.52
pH (+/-0.05)	3.92	3.88
Modified Color Intensity	14.69	13.21
OD 420	5.430	4.860
OD 520	7.360	6.730
OD 620	1.900	1.620
Tannins (g/L)	3.6	4.0
HCl index (%)	19.2	16.4

must was chaptalized with sugar during fermentation.

The must was separated into three samples, each inoculated with 20g/hL of a different yeast strain: the first with the original A-strain, the second with

the new yeast and a third with yeast "F." Other fermentation parameters were identical. Strain identification was confirmed with PCR halfway through fermentation.

Alcoholic fermentation kinetics (Figure V) were similar in all three lots; the fermentation rate (slope) was similar throughout the first stage of fermentation. The lot with the new yeast completed fermentation quickly and cleanly.

All samples were inoculated with the same strain of pre-acclimated bacteria, and had the same lag phase before malolactic fermentation (MLF) started (no negative impact on bacterial development). Table III shows post-alcoholic fermentation analysis results for the wines.

A triangular tasting was organized using wines made with the original strain and new yeast. No difference was perceived between the two wines (statistically significant at 0.1%). This corroborated results of other industry-scale trials with these two strains, performed during the 2007 vintage in several regions and wineries in France, Italy, Spain, California, Chile, and South Africa.

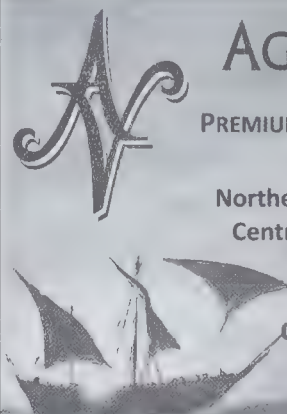
A tasting was also organized to describe the wines made with the new yeast and yeast-F, particularly any differences between wines made using these two red winemaking strains in the same product range. Results are in Figure VI.

Both wines received good marks and were well-balanced, but their profiles were quite distinctive. Wine made with the new yeast had good structure, with silky tannins, and all the character of its grape source (*terroir*). Wine made with yeast-F also had good structure, but it was round and fruitier. The new yeast-wine corresponded to a Grand Cru wine with nice ageing potential, while the yeast-F wine was more expressive.

New yeast and a control tested under more difficult conditions

Once the similarity of wines made with original and new strains had been confirmed by tasting, it was important to test the new strain under more difficult conditions.

Cabernet Sauvignon (2007, SE France) samples received equal treatment in



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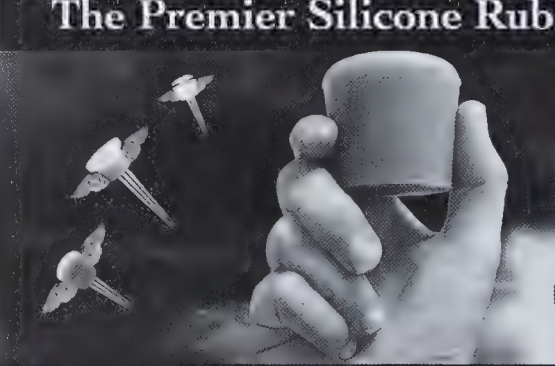
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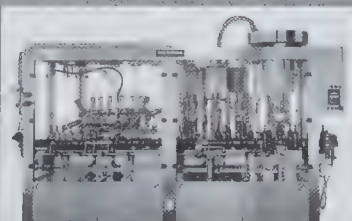
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terms of yeast nutrients, extraction management, temperature control, etc. The only difference was the yeast strain: the control was fermented with the strain usually used by the winery for wine with good ageing potential. Development of the yeast strains inoculated in both tanks was confirmed by genetic analysis (PCR), halfway through fermentation.

Alcoholic and malolactic fermentation kinetics were very similar for both samples, and the wines were analyzed at the end of MLF (Table IV). There was a significant difference in volatile acidity, with 37% less in the X-wine (new yeast) than the control, which had a mean alcohol content of 14.7% v/v. This is particularly important when a wine is to be barrel-aged for 12 to 18 months. Furthermore, the X-wine had a deeper color and more massive structure (HCl index) at that stage.

Comparative tasting revealed that these two wines each had distinctive personalities. The wine fermented with the new yeast was elegant and fruity on the nose, with noticeable tannins that were, however, very soft and silky compared to those of the wine fermented by the control yeast. The control also had a fruity aroma, but it seemed "rouger," less soft and supple on the palate than the X-wine. This assessment confirmed that organoleptic characteristics revealed in the X-wine were certainly inherited from the original yeast strain.

Don Brady, winemaker of Robert Hall Winery (Paso Robles, CA), used the new Zymaflore FX 10 yeast in 2008 to minimize sluggish fermentations and improve kinetics in all Bordeaux variety fermentations.

"We have used several yeast varieties with limited success and were finding ourselves reducing fermentation temperatures in an effort to avoid sluggish and stuck fermentations," says Brady. Despite modified temperature protocols we still experienced occasional lagged finish of fermentation reducing tank turnover with the threat of stuck ferments. The new FX 10 yeast improved kinetics and gave us

prompt completion without sacrificing flavor."

Conclusion

The directed breeding technique enhanced fermentation performance of the original yeast, known as the ideal strain for fine wines intended for long ageing. The new strain, Zymaflore FX 10®, was shown to have superior fermentation kinetics and reduced incidences of stuck or sluggish fermentation, while maintaining all its organoleptic properties, producing elegant wines with good structure.

Directed breeding is a technological breakthrough, which opens up avenues for research, especially as fundamental research has now made it possible to locate certain winemaking traits more precisely on the genome. These tools, together with selection and characterization, will make it possible to develop higher-performance strains that correspond more closely to winemakers' needs. ■

Author's note:

Products used in this study

The original (parent) yeast strain used for this breeding development was Zymaflore F10®, and the new strain developed by directed breeding is now commercially available as Zymaflore FX10®. The enzyme used during fermentation trials was Lafase HE Grand Cru®, inoculation bacteria was *Lactobacillus 450 PreAc*®, and nitrogen-deficiency additive was Thiazote®. The control yeast strain in trials was Zymaflore F15®.

This is an edited version of the full article. For a copy of the complete article containing information about the research conducted by Laffort, please contact: charlotte.gourraud@laffort.com.

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Nuances of temperature

Continued from page 22

collapse due to excessive sugar content. Figure XI shows diurnal ripening patterns for two types of climates. The large diurnal range represents a valley floor location while the small diurnal range represents a mountain location.

Conclusion

California's coastal grape growing regions have variability in climate and soil that continues to intrigue and challenge viticulturists and winemakers. In this article, we introduced some new ideas to help create a better understanding of coastal regions. Concepts like *proximity to the marine influence* and *elevation* create a framework for a different way of thinking about coastal climates, and tools like average diurnal temperatures give us a better understanding of how differences in ripening patterns, flavor development, and wine styles may differ among locations. ■

Thanks to Chris Heliotes, Shelley Black, and Eric Moldstad for their help.

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Reduced environmental impact, greater brand value

BY Jim Caudill

Product innovations rarely please consumers, marketers, producers, and the trade alike, but lightweight glass seems to fit the bill. Raise a toast to innovation that reduces the carbon footprint of the glass manufacturing process, reduces packaging costs, and increases consumer perception of brand equity, at no extra charge. Best of all, this is change with measurable metrics, something that can be evaluated from both an aesthetic and bottom-line evaluation.

While alternative wine packaging such as aluminum, bag-in-box, PET plastics, and multi-layer aseptic seem to be introduced at an ever-increasing rate, the potential for major ecological and market impact remains with glass.

"Everyone is thinking about it," says Erica Hiller Harrop, founder of Global Package LLC (Napa, CA), which focuses on winery clients in the ultra-premium \$25+ category. "Even if they don't think they are thinking about it, they soon will."

"Everyone" includes large wineries such as Wente Vineyards (Livermore, CA) and Fetzer Vineyards (Hopland, CA), and small volume producers like Pacific Rim Riesling (Richland, WA),

and Longboard Vineyards (Healdsburg, CA). The fourth largest U.S. wine producer, Bronco Wine Company (Napa, CA), will implement a major lightweighting changeover in the summer of 2009. A small Santa Barbara County producer, Firestone Vineyards, will introduce a Discovery series in a 14-ounce bottle with a small punt in 2009, retaining traditional quality cues.

In consumer research from the Glass Packaging Institute (GPI), Owens-Illinois (O-I), and Newton Marketing & Research, glass is the preferred package for purity, perceived shelf life, and preservation of flavor compared to alternatives such as PET.

Today's popular mass-market wine bottles average 17.7 to 19.7 ounces, with "premium" bottles averaging 23.6 to 31.5 ounces. At the ultra-premium end of the scale, consumers spending \$50 or more seem to require a sense of "collectible quality," notes Harrop, adding "but just because you can use a dramatically heavier bottle does not mean you should."

Glass manufacturing and environmental impacts

From an environmental perspective, the change to lightweight glass has impacts broad and deep. Horácio

Trujillo, marketing manager at Vitro Packaging (Dallas, TX), notes that a reduction in bottle weight impacts raw materials needs, energy used in production, greenhouse gas emissions, and shipping costs in many dimensions, including fuel used in transport, and the number of bottles that will fit on a pallet and ultimately in a truck.

The cost of consumer recycling and returning the glass into the production cycle for cullet (crushed recycled pre- and post-consumer glass) is part of the equation. In standard bottles, the percentage of cullet used varies widely according to where bottles are manufactured. The average in California is 35%, but in Europe, where environmental concerns have been part of the manufacturing equation far longer, percentages can average above 60%. U.S. members of the Glass Packaging Institute (GPI) have formalized their commitment, with a goal to use no less than 50% cullet in bottle production by 2013.



The 2008 package re-design for Pacific Rim Riesling (right) included glass that is 19% lighter than previous bottles.



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A 10% increase in cullet reduces particulates by 8%, nitrogen oxide by 4%, and sulfur oxide by 10%, with energy costs used in manufacturing dropping 3% to 4%, according to the GPI (see www.gpi.org).

There is clearly a positive impact of green market messaging for consumers who care about going green in all aspects of their lives.

"In the future, more wineries at all price points will find it important to scoreboard their carbon footprint," says Harrop. "Glass producers will offer more eco-choices based on traditional designs."

Producers are already emphasizing these selling points. Saint-Gobain Containers offers ECO Series™ wine bottles, suggesting use of these bottles will reduce a winery's carbon footprint by up to 25%, not including the reductions accruing during transport from winery to distributor, wholesaler to retailer, and retailer to consumer homes (and back again, when the bottle is recycled). Saverglass recaptures 90% of the fume waste from its gas furnaces to reuse as fuel.

Saverglass offers lightweight versions of its best-selling molds like Ancienne 2 (21.1 oz) and Alienor 2 (21.1 oz) that have been available for years, reports Jyll Castangia (sales and marketing manager). "Current market demand is focused on lighter weight without compromising quality or design. The lightest bottle in Saverglass' ECO design line is 17.6 oz, and the heaviest is 28.2 oz, with an average of 26.5 oz that is likely to fall."

Wineries find change easy and logical

Longboard winemaker Oded Shakked and his winery team decided to change from the Saverglass Apparat mold to the Caudalie mold which, at 21.1 oz, is 25% lighter in weight, with the same shape and ring finish for corks and capsules, avoiding any extra costs in the changeover. Longboard's move from a 30 oz to a 21.1 oz bottle resulted in lower carton weight (nearly eight pounds).

The 2006 Sauvignon Blanc was the first wine packaged in lighter glass, and Shakked confirms, "the package is per-

forming just great, with the change almost unnoticed in the marketplace," which was a key goal when the Longboard team made the decision to use lighter bottles. "We wanted little change in the package appearance, and we found that no changes were needed on the production side, with no loss of performance at any step of the bottling process."



Longboard's new Sauvignon Blanc bottle weighs 550 gms, compared to 850 gms in the old glass. The winery saves 7.9 lbs per carton on shipping weight.

For Pacific Rim Riesling, choosing glass that is 19% lighter than the traditional bottle used for Riesling is effortless. Using the lightest screw-cap mold offered by Saint-Gobain Containers is simply logical, notes General Manager/Winemaker Nicolas Quillé. "We view implementing sustainable practices as our moral obligation — it's part of who we are as people — not some empty marketing ploy."

Wente Vineyards began moving to lightweight bottles with the 2004 vintage, first released in 2006. Kevin Zollinger, SVP Winegrowing, said the winery chose new versions of existing molds, with bottle weight savings of 16% to 36%, which reduced carton weights by two to six pounds.

Zollinger notes that Wente was able to move straight to production with new glass, with a minor investment in change parts for only one bottle choice. "Otherwise, introduction of the bottles has been seamless." He echoes other wineries on the decision to change bottles. "The opportunity to reduce our carbon footprint by reducing shipping

weights was an essential part of the decision, but cost savings with continued performance of the package was also key."

By using an existing mold, Zollinger also notes that suppliers gain benefits from economies of scale, maximizing product cost efficiencies, maintaining quality, and further reducing carbon footprint at the point of production. This view of the total lifecycle process is in line with Wente's participation in the Wine Institute's Code of Sustainable Winegrowing.

Tide has turned for mass market wines

Fetzer Vineyards adopted lightweight designs in 2007 for more than 23,000,000 bottles rolling annually off its multiple bottling lines.

With supplier-partner Owens-Illinois, the weight of an average claret bottle used for Valley Oaks red wines was reduced from 19.8 to 15.5 oz, while the burgundy bottle style has moved from 17.5 to 15.5 oz. Some bottles were standard O-I offerings, and in two



Wente's 2004 Riva Ranch Chardonnay bottle (left) weighed 30.3 oz and the new 2008 bottle weighs 22.2 oz. The 2008 bottle has a smaller punt, sloping shoulders, and is shorter by 1.4 cm.



Vitro Packaging packs Wente Vineyards bottles in shipping cartons, and Wente fills the bottles and repacks in the same shippers, eliminating intermediate raw materials. Wente changed shipper design, from conventional bleach liner board to a kraft liner board with recycled content, and using virgin material sourced from sustainable forests. The shipper is printed with soy-based inks, which contain reduced volatile organic compounds (VOC).

cases — a screw-cap Burgundy and magnum Bordeaux bottle — Fetzer worked with O-I to design proprietary molds, according to James Sobbizadeh, Director of Production.

On an average annual basis, lighter bottles reduce glass usage by 16% (more than 2,100 tons) and supply chain greenhouse gas emissions (or carbon footprint) associated with glass bottles by 14% (3,000 tons of carbon dioxide equivalent) as calculated by *Best Foot Forward*, a leading sustainability consultancy (www.bestfootforward.com/). The company was retained by Fetzer to research the total impact of the changes in bottle weight at each stage of the product lifecycle.

"No special change parts were needed for the bottling line, which is running at the same performance ratios as before," says Sobbizadeh. From a production perspective, the major impacts are a reduction in energy usage and a drop in carton weights, from 35.94 lbs for an old Claret bottle to 33.39 lbs for the new glass.

Mike Haering, Fetzer Global Brand Director, says consumers have indicated a rapid acceptance and appreciation for the change. "You always worry about consumer reaction whenever you update or alter a package," he adds. "Will the perception of quality be impacted? Will consumers think the change indicates some greater change in the wine itself?"

"In this case, the only consumer comments received have been appreci-

ation for our commitment to sustainability, and we plan to continue highlighting those efforts, including our choice of lightweight glass."



Fetzer Vineyards is using standard molds in 750ml and 1.5L from O-I's lighter weight glass offerings. Bordeaux bottles are 12% lighter, and Burgundy bottles are 22% lighter than previous glass.



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When lightweight bottles were introduced, Fetzer placed neck hangers explaining the change and touting the environmental benefits, directing consumers to www.Fetzer.com where more information is available. Every bottle of Fetzer Valley Oaks wines carries an "Earth Friendly Wine" logo on the back label.

Role of design to produce lighter-weight bottles

Most glass manufacturers agree that bottle weight has been dropping for years without much notice, as a result of improvements in the production process, especially the ability to control bottle wall thickness and improved process control

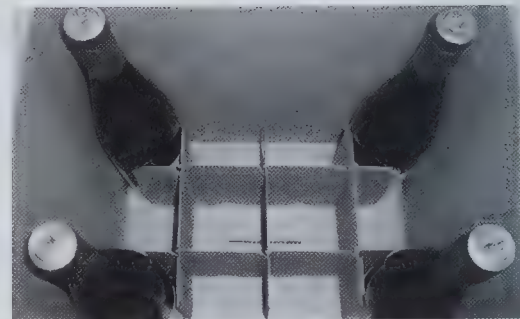
technology, along with standardization in the manufacturing and design processes. Glass containers can be formed at lighter weights while maintaining their strength and inherent glass qualities.

Design plays a major role. Shoulder design and slope (the pinch, or sharpness of the angle where the neck meets the shoulder) may require more glass. Sharp heels (where the sides of the bottle meet the bottom) also uses more.

Advances in design need not be radical. "We're working to reduce average weights by 10% to 20% and most clients look at samples and cannot see the difference, because the changes are so subtle," says Global Packaging's Harrop. "Dropping the weight of a bottle means the cost of shipping to market drops considerably, so making the change saves shipping costs and makes economic sense for winery and consumer, apart from the positive impact on the environment."

Vitro Packaging worked with Bogle Vineyards (Clarksburg, CA) on just such a subtle change in 2006, dropping freight costs by 15%.

Five years ago, O-I began offering a standard mold that removed the traditional punt in the bottom of the bottle without comprising bottle stability, moving from a 19 oz bottle to a 15 oz standard. A 10.5 oz bottle has been offered in Europe by O-I for more than a decade, reports O-I's Mike Lonsdale,



Columbia Crest (Patterson, WA) uses 16.5-oz (average) bottles, which their state-of-the-art bottling line places gently into empty shippers, followed by short, shunted partitions.

but until recently there was little U.S. demand for this reduction in weight.

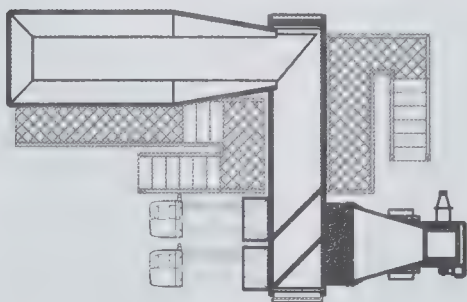
Saint-Gobain Containers' *Revolution* bottle, part of a three-step ECO Series™, weighs 10.55 oz, but for those interested in moving along incrementally, *Evolution* has a small punt and traditional shapes weighing 14 oz, and the *Inspiration* bottle, aimed at retaining high-value clues, has a full punt and pronounced shoulders at a light 16.5 oz.

"It may be that the mass market brands do the heavy lifting and educate consumers about lightweight glass not impacting the quality of the wine, along with the environmental benefits," Harrop explains. "When this is more universally understood, and with today's subtle designs based on new technology, it will be much easier for everyone to change to lighter packages."

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BY Scott Gerien,
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What does the shape of your wine bottle say about your wine? For most American producers, it tells the consumer the variety featured in the bottle — Cabernet Sauvignon or Merlot when using a Bordeaux-style bottle with straight sides and tall shoulders; Pinot Noir or Chardonnay when using a Burgundy-style bottle with gradually sloping side shoulders and a wider girth. These bottle shapes are industry standards, with different bottle manufacturers and wineries using small variations on these generic designs.

The wine industry offers nowhere near the variety of bottle designs found in other beverage industries, such as for vodka, spring water, or energy drinks. Nevertheless, there is still some innovation and creativity.

While some people in the industry may view the use of unique bottle designs as trendy or not suited to the nature of the product, one need look no further than Coca-Cola, Absolut, or Voss for proof that bottle designs can create strong brand imagery in the minds of consumers, especially today's Generation X and Millennial consumers. This lesson was recently taken to heart by Foster's Group in the repositioning of its Rosemount brand.

Throughout its history, the Rosemount brand has featured a diamond-shaped label that consumers have come to associate with the brand. In 2006, Foster's extended this diamond imagery to the design of the Rosemount bottle. The new bottle design reflects a modern aesthetic featuring a diamond base, tapering upward, to create a prism-like effect. This bottle design was sufficiently unique that Foster's was able to obtain an Australian trademark registration for the bottle shape, and a design patent in the U.S. and design registration in Europe and Canada.

Bottle design as intellectual property

Beverage bottle designs occupy a unique position within the intellectual property world. They are functional items; their purpose is to hold and pour beverages. Yet they are also packaging, which may be uniquely associated with the beverage contained within. Their industrial function allows them to receive a utility patent where they offer some type of unique utilitarian advantage, such as allowing the beverage to be poured in a manner that will result in less dripping.

If a bottle design does not offer any utilitarian advantage, but offers some type of unique design element, such as being shaped like a boot, then that design element may be protected by a design patent. Such patents provide the owner with a monopoly on the utilitar-

ian function or design covered by the patent, but are of limited duration — utility patents have a term of 20 years and design patents a term of 14 years.

Fortunately for beverage producers, because the bottles serve as packaging for the beverage product, which can be associated with the beverage brand, their shapes may also be protected as trademarks if they are unique or shown to have become recognized by consumers as unique to the particular producer. It is this trademark protection which prevents soda companies from using the Coca-Cola bottle design long after any patent for the bottle design would have expired.

Since trademarks remain valid and in effect as long as they are used in commerce, a bottle design protected as



Rosemount Estate (Australia) introduced nine wines with a diamond-shape label and diamond-base bottle (with design patent) in 2006.

a trademark may be exclusively used by the producer in perpetuity.

For example, The Wine Group owns both a design patent registration and a trademark registration for its unique "olive-oil-type" bottle design for its Corbett Canyon wines. The design patent for this bottle design expires on March 3, 2012. However, The Wine Group also obtained a trademark registration for the bottle design as used with wine, which means The Wine Group can continue to exclusively use the registered bottle design as long as wine is being sold in the bottle.

Conflicting ownership issues

This dual protection scheme available for bottle designs also has the potential to create conflict between parties with different interests in the same design, specifically the bottle manufacturer and the wine producer. A patent right belongs to the inventor of the bottle design, while a trademark right belongs to the user of the design in commerce.

If a wine producer goes to the bottle manufacturer with a concept for a design (such as a bottle shaped like a pyramid) and the bottle manufacturer puts that concept to paper in creating the specific design, the bottle manufacturer will own the design patent as the inventor.

However, the parties may agree that the patent will be assigned to the wine producer pursuant to the production agreement, or that the wine producer will have some type of exclusivity to the design (such as exclusive use in the beverage field).

While a wine producer may claim trademark right in the design through

use of the design in commerce, absent some exclusivity arrangement, the bottle manufacturer, relying on its patent, may choose to make the design available to other wine producers. While this would lead to an interesting legal issue relating to conflicting interests in different types of intellectual property, most successful business plans for wineries do not involve budgeting for creating new laws concerning bottle design. Accordingly, wine producers and bottle manufacturers should be sure to determine such ownership and exclusivity issues in the production agreement for a bottle.

Importance of protecting a design

Unlike a trademark right, which takes effect based upon the use of the trademark in commerce, a patent right can only be secured via registration of the design with the U.S. Patent and Trademark Office through application within one year of public disclosure of the design. If the inventor does not act to obtain the patent, no patent right can subsequently attach to the design.

In the context of a bottle manufacturer creating a unique design as part of its general line of bottle products, or on an exclusive basis to a particular customer or customers, not obtaining a patent means that other bottle manufacturers are free to use that same design, or a wine producer with interest in the design may legally bring it to a competing bottle manufacturer to be copied. This highlights the value of protecting the unique design from both sides of the bottle supplier/wine producer relationship.

While an exclusivity arrangement between the winery and bottle manu-

facturer is certainly necessary for the winery to keep the design restricted for its use, this does not prevent another winery from having the same design produced by a different bottle manufacturer. For this reason, a winery should obtain a design patent and/or trademark registration for a unique bottle design.

Absent a patent, there can be no claim for patent infringement, and absent a trademark registration, there



Homard bottles 1,000 to 2,500 cases per year of white Zinfandel (sourced from Madera, CA) and white Merlot (North Fork, Long Island, NY) in lobster-shaped, trademarked bottles. Wines are sold in New England states for \$9.99 to \$12.99.

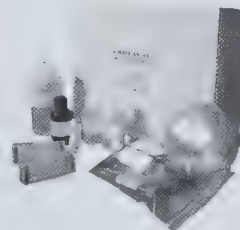
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is a very high burden in demonstrating that the bottle design is sufficiently unique so as to serve a brand identifier for the winery.

Bottle design as branding strategy

Undoubtedly the design of a unique bottle mold, preparation of exclusivity agreements, and filing for patent or trademark registration are not inexpensive endeavors. However, this does not mean that the protection of unique bottle designs is limited only to high-production wineries. Small wineries can create strong branding through the use of unique bottle designs and thereby stand out from the crowd. Take the example of Homard Wine.

Homard Wine is a Cape Cod concern that sells California White Zinfandel and New York White Merlot under its Homard brand in a bottle shaped like that most ubiquitous of New England icons, the lobster. The lobster bottle design is the subject of a U.S. trademark registration for wine, which means that Homard owns the exclusive right to use a wine bottle shaped like a lobster.

While this may seem more like a novelty than a sustainable brand, Homard's owner, Bruce Wolf, reports that annual production of the wine is between 1,000 and 2,500 cases. As there are many wineries out there that have great difficulty in moving 1,000 to 2,500 cases of wine, even if one views the Homard lobster bottle as a novelty, it is clearly a successful branding strategy.

Bottle design trends

What is most surprising about the wine industry relative to other beverage sectors is the fact that unique bottle designs have not been used more prevalently to attract market share through brand presence.



Wine Group registered the Corbett Canyon bottle design in 1999.

One need only visit the wine aisle in a supermarket or liquor store to see the sameness of wine bottle design and how no wine bottles really stand out from the crowd. Go around the corner to the liquor aisle and it's a completely different story, with vodka bottles carrying the same 750 ml volume in a vast array of shapes and dimensions.

Undoubtedly, there are those wine drinkers who prefer the generic wine bottle design because they view wine as very serious and traditional.

However, with the shifting wine demographic and growing influence of Generation X and Millennial consumers, producers may wish to consider a different bottle aesthetic in establishing or re-establishing their brand. Probably they should look less to the Homard

lobster bottle and more to the Rosemount diamond bottle as this demographic tends toward a cool sophistication — more iPod, less Walkman.

What is clear, though, is that wine bottle design remains an untapped resource for brand building in an overwhelmingly crowded market, especially with the newest generation of wine drinkers. ■

[J. Scott Gerien has represented wineries and vineyards on trademark matters for more than twelve years. He is head of the intellectual property department of Dickenson, Peatman & Fogarty (Napa, CA), a member of the DP&F's wine industry practice group, and Chairman of the International Trademark Association's North American Committee on Geographical Indications. He may be reached at 707/252-7122 or sgerien@dpf-law.com.]

Fight The Recession!



FINGER LAKES wine posters evoke WWII spirit

How can you market your wines during a recession? Look to former recessionary times and try a modern take on a campaign that worked then.

Dan Mitchell of Fox Run Vineyards (Penn Yan, NY) had an idea for marketing Finger Lakes wines during the current economic recession that started with World War II's "Rosie the Riveter" image, and grassroots efforts of the era encouraging consumer support in tough times.

Graphic designer Joanna Purdy, who created three labels for Fox Run and is married to winemaker Peter Bell, incorporated the modern, popular "Buy Local" slogan in the poster art. Finger Lakes Wine Country printed 500 11x17-inch posters and spread them throughout wineries in the Finger Lakes region. 2,500 more posters have been distributed to wineries and wine associations in California, Oklahoma, Texas, Washington, and the Hudson Valley and Long Island, NY.

Fox Run sells the poster for \$5 in its tasting room and \$6 on its website, www.foxrunvineyards.com. ■



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LABEL PRINTING • PACKAGE DESIGN

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Bruni Glass Packaging . . .85	Cryotech International . .90	O-I 87
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Cork Supply USA 80	KLR Machines 89	Zork USA 89
CorkTec 88		

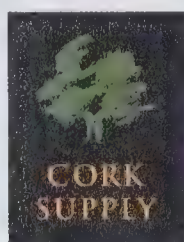
CORK SUPPLY USA, INC.

Founded in California in 1981, Cork Supply is a primary supplier of premium natural wine corks in North America. Cork Supply also offers a comprehensive collection of best-in-class top-of-the-bottle products.

From corks to capsules, screw caps to synthetic and sparkling closures, wineries depend on Cork Supply "for everything from the neck up."

Recognized as wine industry "Top-Of-The-Bottle Experts," the experienced sales, customer service, and technical laboratory professionals at Cork Supply can help select and customize the right finish for each wine.

Cork Supply specializes in offering a complete line-up the world's finest performance closures and capsules — all backed by a passionate commitment to quality assurance and customer satisfaction.



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For more information, contact:

Cork Supply USA, Inc.

531 Stone Road, Benicia, CA 94510
tel: 707/746-0353; fax: 707/746-7471
e-mail: csu@corksupply.com
website: www.corksupply.com

PLEASE SEE CORK SUPPLY USA AD, PAGE 50.

SAVERGLASS, INC.

Saverglass is for makers and marketers of ultra-premium wines, who understand the necessity of distinctive packaging for brand recognition and shelf positioning.



Saverglass has three production plants in France (Feuquieres, Le Havre, and Arques), which produce 300,000 tons of glass per year. Integrated decoration capabilities include 11 ceramic printing lines, two color-coating lines, two organic printing lines, and an acid etching plant. Saverglass offers all necessary options for customization and decoration with the highest possible quality, innovation and service.

Call for a showroom appointment to see the new ECO DESIGN line and review the latest Portfolio and Creative Glass, highlighting top Saverglass products created over the past 12 months. Saverglass is both ISO 14001 and 9001 certified, and meets the most rigorous standards of quality in the industry.



For more information contact:

Saverglass Inc.

West Coast:

Sylvie Langlois, Sales Account Manager
Jyll Castangia, Sales Account Manager
Petra Gillier, Sales Account Manager
Audrey Vaney, Sales Administrator
841 Latour Ct., Suite B, Napa, CA 94558
tel: 707/259-2930; fax: 707/259-2933

East Coast:

Doug Thompson, Regional Sales Manager
Anna Cutri, Sales Administrator
107 Spring St, #210, Ramsey, NJ 07446
tel: 201/825-7100; fax: 201/825-7117
www.saverglass.com

PLEASE SEE SAVERGLASS AD, PAGE 2.

QUICKLABEL SYSTEMS

Owning a QuickLabel digital label printer allows wineries to create and instantly print their own wine labels. By printing wine labels digitally, wineries are free to make labels in the exact quantity needed for each wine without meeting the "minimum purchase quantity" required by commercial label printers. Wineries can also offer their customers personalized wine labels for use as corporate gifts and wedding favors.



QuickLabel offers two digital label printers for wineries:

- The floor-standing Vivo! label printer is designed for large-scale production, printing wine labels for case-goods, and private label wine according to sales demand.
- The affordable Zeo! desktop label printer is designed for low-volume, boutique winery production, or for printing personalized labels in tasting rooms and gift shops.

Both QuickLabel printers can make wine labels for front and back of the bottle, wine labels in virtually any size or shape, in either matte or gloss finish.

Both printers allow wineries to make die-cut wine labels with full-bleed label artwork, and offer customers the option to create a wine label template that can be customized to make wine labels with photos, special messages, name, logos, and more.

For more information, contact:

QuickLabel Systems

600 East Greenwich Ave.
West Warwick, RI 02893
tel: 877/757-7978; fax: 401/822-2430
e-mail: info@QuickLabel.com
website: www.QuickLabel.com/wine

PLEASE SEE QUICKLABEL SYSTEMS AD, PAGE 18.

CASTORO BOTTLING COMPANY

Since 1989, Castoro Bottling has served wineries throughout California with a fleet of high-tech mobile bottling lines. The demand for Castoro Bottling's timely, professional, and knowledgeable service has triggered the bottling of over 48 million bottles of wine with natural cork, synthetic closures, and screwcaps.



Castoro Bottling offers three technologically-advanced mobile bottling lines that arrive on your schedule to serve all your bottling needs. Castoro Bottling can bottle up to 2,500 cases per day, serving any size winery. A number of custom services are offered, including labeling and packaging consultation. Recognizing the need for wineries to offer alternative closures, Castoro Bottling has outfitted two bottling lines with screwcapping and Zork capability. Castoro Bottling can handle 187ml bottles.

"Our investment in the best equipment and the best people to run that equipment is what sets Castoro Bottling apart," says Niels Udsen. "We anticipate the needs of a winery better than any other bottler simply because I have owned and operated a successful winery for over 25 years. Castoro Bottling is a partner who knows and understands your business."

Since 2005, Castoro Bottling Company has offered Velcorin dosing. Please call or visit the website.

For more information, contact:

Castoro Bottling Company

Niels Udsen

PO Box 954, Templeton, CA 93465

tel: 805/467-2002; fax: 805/467-2004

e-mail: Niels@castorobottling.com

website: www.castorobottling.com

PLEASE SEE CASTORO BOTTLING AD, PAGE 33.

CALIBER WINEPAK

Caliber WinePak, supplying packaging with an eye to success since 1982, now has eco-friendly options for wine bottle needs. The ECO Series™ wine bottles by Saint-Gobain are lightweight but still durable, helping protect both the environment and the wines. Saint-Gobain has the goal of using 66% cullet in ECO Series™ glass production.

ECO Series™ 750 ml bottles come in Bordeaux and Burgundy shapes, with full push-up, mid-push-up, or flat-bottom punt options. Available colors include Champagne green, flint, dead-leaf green, or antique green (call for availability of certain colors by mold). Saint-Gobain partnered with American Glass Research and major bottlers to test the ECO Series™ on the most challenging and fastest bottling lines.



CALIBERWinePak™

Caliber also supplies a Bag-in-Box option, including leasing the filling equipment. Global sources, including Asian, round out Caliber WinePak's wide range of wine packaging options. If a unique project requires design capabilities, Caliber WinePak has an award-winning design group that can bring the winery's vision to fruition.

Options do not punch a time clock. Search www.caliberwinepak.com for 24-hour access to a large library of packaging information. Options are what make the seemingly impossible, possible. Caliber WinePak brings wineries the most packaging options available in one place.

From the spark of the idea to the wine on the shelf, contact Caliber WinePak... "Because Our Options Make the Difference."

For more information, contact:

Caliber WinePak,

a division of TricorBraun

603 Indiana St., Benicia, CA 94510

tel: 707/747-1055; fax: 707/747-1064

e-mail: pblanchard@caliberwine.com

website: www.caliberwinepak.com

PLEASE SEE CALIBER WINEPAK AD, PAGE 59

GANAU AMERICA

With total, end-to-end control of the cork production process, Ganau America goes above and beyond standard industry practice at every step, with extra effort to ensure top quality, and take every possible precaution against development of cork taint.



GANAU

CORK TRADITION & TECHNOLOGY

Ganau offers responsiveness, quick turnaround, and close attention to every detail. The dedication to quality and service has earned the loyalty of customers — winemakers who want the best.

In 1995, Ganau introduced TF-technology, the industry's first non-chemical deep-cleaning steam process for natural corks, granules, and discs. It established a new industry best practice that other producers have since worked to emulate.

Ganau is again leading the way with Ganau Revolution™ — another major advance to control cork taint. The Rain Autoclave was designed to purify cork planks with super-heated water droplets and steam. This non-immersion system allows cleaning at higher temperatures (up to 120°C) than other boiling methods. Hotter water means higher pressure to drive purifying steam even deeper within cork lenticels. Use of fresh, pre-heated water for each batch eliminates any risk of cross-contamination (less advanced boiling systems merely filter and recirculate water).

For more information, contact:

Ganau America

21750 Eighth St. East, Sonoma, CA 95476

tel: 800/694-CORK; fax: 707/939-0671

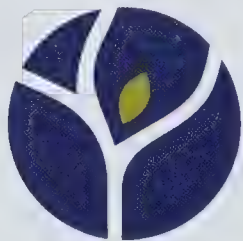
e-mail: mariella@ganauamerica.com

website: www.ganauamerica.com

PLEASE SEE GANAU AMERICA AD, PAGE 27.

JUVENAL CORK

Juvenal Cork (formerly Juvenal Direct) introduces the Econatur line of wine corks, with totally chemical-free processing. Cork trees are sustainably grown under the auspices of the Forest Stewardship Council (FSC) and certified that all harvested bark is grown under organic guidelines, certified by Europe's ECOCERT organization. Cork bark is boiled in filtered, non-chlorinated water, and cleaned using high-pressure steam from de-ionized water.



JUVENAL

C O R K

The corks are treated in Juvenal's patented low-intensity microwave DELFIN system to remove volatile aromatics. Individual corks are washed in Juvenal's PERFECT production system using only steam and water, which is filtered and deionized.

Econatur corks include Natural, champagne, and Twin Perfect 1+1, the Perfect Natur micro-agglomerate cork, and the Perfect Natur II (a Micro-agglomerate 1+1 cork).

Juvenal has added two new personnel to its sales team — Kim Boyarsky, formerly with Caliber WinePak, and Jenny Morgan, from the Robert Hall Winery (Paso Robles, CA). Juvenal Cork is a member of the Cork Quality Council, and all cork lots conform to CQC standards regarding sensory characteristics.

For more information, contact:

Juvenal Cork

120 Dodd Ct., American Canyon, CA 94503
tel: 707/254-2000; fax: 707/642-2288
e-mail: salesusa@juvenalcork.com
website: www.juvenalcork.com

PLEASE SEE JUVENAL CORK AD, PAGE 55.

SAINT-GOBAIN CONTAINERS, INC.

As a leading glass container supplier to American wineries, Saint-Gobain Containers offers a legacy of product innovation, craftsmanship, and customer attention. The company is committed to maintaining this position in the market through forward-looking technologies, and by providing the services customers require. Saint-Gobain Containers has focused on both innovation and customer support through two company-wide initiatives, Vision2SustainSM and The Vision4GlassSM Process.

The Vision2SustainSM initiative was created in order to facilitate the ongoing development of eco-friendly products and practices. The Vision4GlassSM Process allows designers to be involved in the earliest design phase with customers, to shorten package development time.

Both initiatives have been combined to develop a major improvement in sustainable design and manufacturing, Saint-Gobain Containers' new ECO SeriesTM. This innovative series of bottles maintains quality and attributes associated with the customer's glass container needs, while reducing the overall impact on the environment. See listing for distributor Caliber WinePak for more details on the ECO SeriesTM line of wine bottles.

SAINT-GOBAIN CONTAINERS

Saint-Gobain Containers is proud of its partnerships with America's most accomplished vintners and the role its products have played in the growing worldwide recognition of American wines.

For more information, contact:

Saint-Gobain Containers, Inc.

2600 Stanford Ct, Fairfield, CA 94533
tel: 707/437-8717; fax: 707/437-8741
e-mail: marketing@saint-gobain.com
website: www.sgcontainers.com

PLEASE SEE SAINT-GOBAIN AD, PAGE 75.

RAMONDIN USA, INC.

As a leading worldwide supplier of quality tin capsules, Ramondin has the latest innovative products and production capabilities to make truly world-class packaging. Ramondin has been making capsules for the wine industry since 1890. Ramondin was the first tin capsule manufacturer to receive ISO 9001 certification, complying with strict standards of quality, safety, and service, and the ISO 14000 certificate, which has special emphasis on protecting the environment.

Customized modifications to Ramondin's printing machines have created a proprietary production process, which allows printing of virtually anything imaginable.



Ramondin has implemented a reuse/recycling program. Recyclability is one of tin's great merits. Ramondin's recycling program encourages wineries to return plastic trays for reuse in new tin capsule orders. Tin is an excellent replacement for environmentally undesirable metals and plastics. Ramondin buys the purest tin and processes the metal into the perfect capsule. Ramondin's continued commitment to protecting the environment has led to development of water-based paints — no more solvents.

When designing new packaging, Ramondin can advise which capsule is best with a given label. If only bottling small wine batches, ask about Ramondin's stock capsules.

For more information, contact:

Ramondin USA, Inc.

2557 Napa Valley Corporate Dr., Ste. G
Napa, CA 94558
tel: 707/944-2277; fax: 707/257-1408
e-mail: ramondinusa@ramondinusa.com

PLEASE SEE RAMONDIN USA, INC. AD, PAGE 3.



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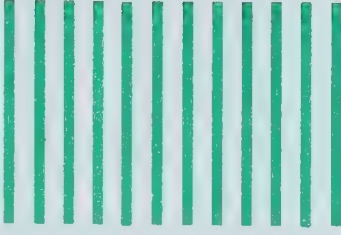
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Rhoda Stewart

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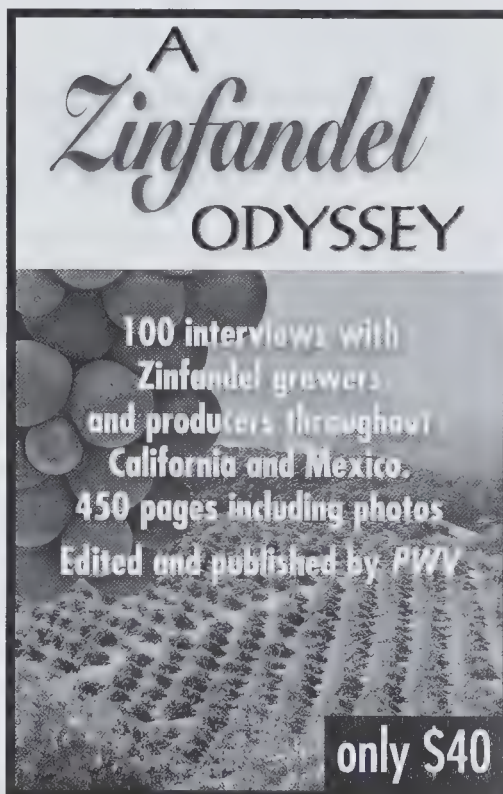
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RIVERCAP USA

Rivercap USA, a division of Cork Supply USA, is the exclusive supplier of Rivercap™ premium tin and poly-lam capsules for the North American wine industry.

Rivercap premium quality capsules add the perfect finish to a wine bottle. An infinite array of dimensional, color, design, top-emboss, and side-print possibilities makes it easy to customize perfection. Over 500 million bottles per year from thousands of the world's finest wineries depend on Rivercap capsules for consistent quality, performance, and style.



RIVERCAP USA

Backed by more than 30 years of experience, Rivercap is an established world leader in the manufacture and design of premium decorative wine capsules. Among many Rivercap 'firsts' are the launch of the popular lightweight 80-micron capsule, and the inside/outside super-cleaning capsule system for improved capsule performance.

Other critical Rivercap advantages include:

- a nine-stage deep-drawn shell for an elegant, flawless finish;
- two-color registered side printing;
- high-resolution top embossing;
- high scuff-resistance;
- flexible product dimensions;
- compliance with CONEG heavy metal limits (under 100 ppm).

Rivercap USA offers specialized expertise from an enthusiastic, veteran sales and support team. Rivercap capsules are online at www.corksupply.com. For urgent needs, stock tin and poly-lam capsules are available in Northern California.

For more information, contact:

Rivercap USA

531 Stone Road, Benicia, CA 94510
tel: 707/747-3630; fax: 707/746-7471
e-mail: jbell@rivercapusa.com
or sales@rivercapusa.com
website: www.corksupply.com

GARVEY CORPORATION

Garvey Corporation can help wineries increase bottling line production, build a new line or expand it to meet market demand, and run PET bottles.



For more than 40 years, Garvey Corporation has specialized in bottle accumulation, conveyor technology, and production line analysis. The Garvey Infinity Series Bottle Accumulation Table is a flexible and reliable defense against downtime. The Garvey Infinity can accumulate reverse-tapered wine bottles, providing valuable reaction time to line malfunctions. It can also incorporate smooth multi-laning for case-packers, and high-speed single-filing for labelers.

Infinity tables come with 1 to 5 minutes of zero backpressure accumulation, keeping a bottle filler running no matter what happens downstream. Infinity tables work equally well for straight-wall bottles. Garvey has a solution for every size bottling line, from 10,000 cases per year to 10,000 cases per hour.



Garvey has helped clients install accumulators into spaces where no other solution would fit; all while increasing productivity as much as 30%.

Garvey's Pacific Regional Sales Office can be contacted at 415/640-3695 or svarni@garvey.com.

For more information, contact:

Garvey Corporation

208 S. Route 73, Blue Anchor, NJ 08037
tel: 800/257-8581
e-mail: infinity@garvey.com
website: www.garvey.com

PLEASE SEE GARVEY CORPORATION AD, PAGE 8.

CORTICA BENICIA USA

Cortica Benicia USA (CB USA) produces and distributes a large variety of corks, from very small tapered corks to champagne corks, wine corks (to fit any bottle), bar tops (with both plastic and wooden tops) and more. CB USA will print, stamp and/or color corks to match most designs. CB USA corks are scrutinized using the most sophisticated equipment available, and are very reasonably priced.

The laboratories of CB USA are state-of-the-art, analyzing corks of the highest quality. They are equipped with the latest mechanical, chemical, and sensory devices to ensure the very best product available. CB USA provides innovation and technology with an eye to sound environmental and ecological protection.



CB USA supplies capsules (PVC and poly-laminate), and screw caps in a myriad of colors. CB USA provides wax in solid colors and metallics, including three different golds and two silvers, and will match any color provided. CB USA stocks wood boxes in many configurations, and can produce custom-designed boxes.

"If you can imagine it, we will find a way to produce it."

For more information, contact:

Cortica Benicia USA

2487 Courage Drive, Fairfield, CA 94533
tel: 800/532-2207
e-mail: info@cbcork.com
website: cbcork.com

PLEASE SEE CORTICA BENICIA AD, PAGE 24.

NuKorc USA

NuKorc was founded in South Australia in 1996, with the contributions of people such as wine industry icon Wolf Blass, former Constellation Wines CEO Stephen Millar, and award-winning entrepreneur and extrusion specialist Brian Dolling. NuKorc has grown into a worldwide, respected synthetic wine closure producer, whose closures have been adopted by some of the most important wine groups in the world. The U.S. market is serviced through a NuKorc facility located in Napa, CA.



NuKorc

NuKorc believes that every bottle of wine is important and deserves the best. NuKorc synthetic wine closures preserve the true characters of wine, bottle after bottle, so that wine arrives at the customer exactly as the wine-maker intended.

NuKorc FRESH, the latest development from NuKorc, has significantly improved oxygen barrier performance.

NuKorc is HACCP, GMP, and BRC-certified, and has been tested and approved by some of the strictest quality control departments within wine groups from the U.S., Europe, and Australia.

With more than 12 years' experience manufacturing uniquely extruded synthetic closures, NuKorc is a trustworthy business partner. NuKorc: We seal your future.

For more information, contact:

NuKorc USA, Inc.

470 Technology Way, Napa, CA 94558

tel: 707/224-3066; fax: 707/224-3077

e-mail: sales@nukorc-usa.com

website: www.nukorc.com

PLEASE SEE NUKORC AD, PAGE 31.

BRUNI GLASS PACKAGING, INC.

Bruni Glass Packaging Inc. has been serving the wine, champagne, and spirits markets with glass containers for several years, paying particular attention to specialty products, often developed to suit customers' specific requirements. Bruni offers continuous research, new shapes, and concepts to fulfill market and winery expectations.



bruni glass packaging

your product our shape

Bruni's distribution centers located in Italy, the U.S., and Canada serve a worldwide clientele. The in-house design and development team offers experience and innovation in glass design and technology, and are specifically trained and specialized in the field of glass packaging. Bruni clients receive continuous updates of packaging developments.

Bruni Glass SpA has launched "Progetto Millennio," a unique design competition which looks to schools of design around the world for the conception of new glass shapes.

Bruni offers a range of more than 3,000 special bottles and containers in any shape, capacity and color. Bruni containers are unique in design, color, and glass weight. Take a look at the products in the Bruni portfolio and contact Bruni Glass for professional packaging design and development.

For more information, contact:

Bruni Glass Packaging, Inc.

Leonardo Mocci, West Coast

e-mail: leonardo.mocci@bruniglass.com

Mark Bassel, East Coast/Canada

e-mail: mark.bassel@bruniglass.com

4186 Park Rd, Benicia, CA 94510

tel: 707/752-6200;

toll-free: 877/BruniGlass (278-6445)

fax: 707/752-6201

website: www.bruniglass.com

PLEASE SEE BRUNI GLASS PACKAGING AD, PAGE 39.

AMORIM CORK AMERICA

Amorim Cork America is the U.S. subsidiary of Amorim and Irmãos of Portugal, the world's largest manufacturer of natural cork wine closures. Amorim Cork America provides sales, service, and custom finishing services to wineries throughout the U.S.

Amorim's quality assurance standards are the highest in the industry. In addition to offering ROSA, a proprietary steam-distillation treatment to reduce TCA, the company is the first to offer sustainable FSC-certified cork closures.



AMORIM CORK AMERICA

Amorim Cork America offers a full line of natural cork products:

Natural straight cork in standard 24mm diameter; 38mm, 45mm, 49mm, 51mm, and 54mm lengths available in two washes: BWC+ or Natural.

Spark® cork, designed for sparkling wine and utilizing INOS II-washed disks to eliminate off-aromas.

Twin Top® cork, a closure with an agglomerated mid-body with an INOS II treated disk at each end, widely accepted for its consistency of size, performance, and sensory neutrality.

Acquamark, a high-quality, low-cost alternative for wines meant for early consumption.

Neutrocork®, a micro-agglomerated closure made of ROSA-treated particles that make it price-competitive while maintaining excellent sensory values.

Amorim Cork America is a member of the Cork Quality Council. All corks are subject to GC/MS testing for TCA at ETS Laboratories prior to acceptance into inventory.

For more information, contact:

Amorim Cork America

2557 Napa Valley Corporate Dr., Ste. A

Napa, CA 94558

tel: 707/224-6000; fax: 707/224-7616

e-mail: info@amorimcorkamerica.com

website: www.amorimca.com

SCOTT LABORATORIES, INC.

Scott Laboratories is one of the oldest American suppliers of packaging materials to the North American wine and beer industries. For over 50 years, it has been on the leading edge of the industry — emphasizing quality, service, and innovation. Scott Labs offers a broad range of products, including natural corks, screwcaps, champagne corks, and wirehoods.



Scott Laboratories is a founding and continuing member of the Cork Quality Council, continuing to work to control and eliminate TCA in corks. Scott screens all corks for TCA using SPME machinery in Portugal and at ETS Laboratories.

Scott Laboratories offers Alplast Chiusure SpA screwcaps that have a broad range of artwork possibilities such as hot stamping and printing using lithographic and offset processes. Saranex and tin liner options are available.

For champagne corks and wirehoods, Scott Laboratories continues its long-term relationship with Relvas Corticas and ICAS SpA. Relvas Corticas, that is unique among champagne cork suppliers. All wood is purchased directly from the forest, and all materials are sourced and processed in-house. ICAS is the world's largest and most advanced producer of wirehoods and the leading supplier in Europe, North America, and Australia.

For more information, contact:

Scott Laboratories, Inc.

PO Box 4559, Petaluma, CA 94955

tel: 707/765-6666; fax: 707/765-6674

e-mail: info@scottlab.com

website: www.scottlab.com

PLEASE SCOTT LABORATORIES AD, PAGE 52.

ENCORE!

ENCORE! has been supplying and serving wineries since 1975 and has grown to fulfill the glass and packaging needs of over 1000 wineries in the western United States. ENCORE! has attained this growth by meeting and exceeding customer expectations by providing individual attention they deserve.

ENCORE! distributes more than 90 wine moulds in nine different colors with various finishes that range in sizes from 187ml to 27L. ENCORE! also imports a wide selection of European style bottles for special products.

ENCORE! provides mobile decanting services and repacking alternatives.

With over 30 years of experience, ENCORE! is a leading innovator in wine packaging to meet winery needs for bottles, ceramic decorating, litho cartons, specialty bottles, or regular bottling needs. Encore! is the exclusive supplier of Vinoseal, a pioneering glass closure solution, in the United States. Encore's sole focus is on value-added packaging for wineries.

ENCORE! also supplies molded wine shippers in two- and three-pack formats with matching cartons that meet Wine Institute/CAWG purchasing guidelines for sustainable packaging. Two-pack trays are available in two-, four-, six-, and 12-pack shippers. Three-pack trays are available in three-, six-, and 12-pack shippers.

For more information, contact:

ENCORE!

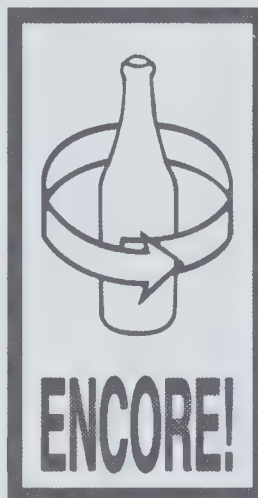
4345 Industrial Way, Benicia, CA 94510

tel: 707/745-4444; fax: 707/748-4444

e-mail: sales@encoreglass.com

website: www.encoreglass.com

PLEASE SEE ENCORE! AD, PAGE 71.



EMPIRICAL MAINTENANCE SOLUTIONS

Empirical Maintenance Solutions (EMS) is a leading provider of services, "working to find solutions" for any type of bottling and packaging equipment. EMS provides the following expertise:

- Consultations;
- Project development;
- Equipment sourcing;
- Engineering;
- Service and troubleshooting;
- Installation;
- Instruction.

EMS can provide many levels of service, from single machine replacement, to designing and installing a complete bottling or packaging line. EMS works with equipment manufacturers worldwide to match the right equipment to each winery's customized needs.



EMPIRICAL

Maintenance Solutions

Empirical Maintenance Solutions can help take a packaging equipment project from initial concept to completion and delivery of wine to consumers. Contact EMS to discuss partnering with your winery for current needs or upcoming projects.

For more information, contact:

Empirical Maintenance Solutions

John Clark, President

1584 Los Alamos Rd., Santa Rosa, CA 95409

tel: 707/539-3334

e-mail: john.clark@empiricalms.com

website: www.empiricalms.com

PLEASE SEE EMPIRICAL MAINTENANCE SOLUTIONS AD, PAGE 64.

C&E CAPSULES

C&E Capsules manufactures premium quality "Elite" polyam, Champagne, and PVC capsules in a new manufacturing facility in Fairfield, CA. C&E can make custom capsules of any size, with decorating capabilities including foil stamping and embossing on both the side and the top. C&E carries a wide array of stock colors that will enhance any bottle, label, and package design. C&E poly laminate material is very heavy to spin evenly like tin.

C&E manufactures long-skirt screw caps that are environmentally friendly and aesthetically pleasing. C&E makes a special *Double-Seal* tamper-evident long-skirt screw cap that will protect wine from tampering, while giving the look of a capsule. Please call for more details.



C&E CAPSULES

C&E is wholly owned by Enoplastic (Varese, Italy), the largest capsule manufacturer in the world.

Enoplastic is a family-owned business which has been making capsules since 1957, and is ISO 9001:2000 certified.

For more information contact:

C&E Capsules

2487 Courage Dr, Ste 5, Fairfield, CA 94533
tel: 707/207-7904

Debbie Jennings, Sales, ext 307

Stefan Bunk, Operations, ext 308

Charles Russell, Customer service, ext 306

PLEASE SEE C&E CAPSULES AD, PAGE 58.

COLLOPACK SOLUTIONS, LLC

ColloPack Solutions is a leading provider of integrated bottling lines and grape processing systems. ColloPack offers a comprehensive line of bottling equipment from single machine replacements to complete lines, including:

- Bertolaso Cleaner/Filler/Corker/Capper Bloc;
- Robino & Galandrino capsuling equipment;
- Cavagnino & Gatti pressure-sensitive and wet-glue labelers;
- Francesca pumps;
- Bertolaso automated conveying systems;
- Perrier & Champagel sparkling wine bottling machinery;
- CIVision bottle, closure, and label inspection/rejection systems.

ColloPack also provides engineering, project management, installation of equipment, conveyors, and electrical, and after-sales service and parts programs customized to each winery's needs.



COLLOPACK SOLUTIONS LLC

For more information, contact:

ColloPack Solutions, LLC

Dave Means, Phil Giacalone, Rick White,
Joe Mironicki, Mike Wlodarczyk,

Craig Richardson or Greg Fulford

193 Camino Dorado, Napa, CA 94558

tel: 707/258-3940; fax: 707/258-3949

e-mail: sales@collopack.com

website: www.collopack.com

PLEASE SEE COLLOPACK SOLUTIONS AD, PAGE 11.

O-I

Established in 1903, O-I is a leading glass manufacturer employing more than 24,000 people, with 82 manufacturing facilities in 22 countries.

Millions of times a day, O-I glass containers deliver many of the world's best-known consumer products. With the leading position in Europe, North America, Asia Pacific and Latin America, O-I produces consumer-preferred, 100% recyclable glass containers that enable superior taste, purity, visual appeal, and value benefits for wines.



O-I works closely with its customers to provide the best options for their wine packaging needs.

The company is constantly updating its portfolio of wine bottles to cater to market trends, including premium branding and lightweight containers.

For more information, contact:

O-I

Stan Gossett, VP, Category Director, Wine

Kelley Yoder, Marketing Manager, Wine

5195 Fermi Drive, Fairfield, CA 94534

tel: 707/646-7417

e-mail: kyoder@us.o-i.com

or sgossett@us.o-i.com

website: www.o-i.com

PLEASE SEE O-I AD, PAGE 7.

CORKTEC

CorkTec serves the East Coast and North America by receiving stoppers directly from Portugal, saving both time and money on the delivery of cork stopper inventory.

CorkTec has between one and two million stoppers in a Connecticut facility ready for branding with a customer's logo. CorkTec's large inventory and new equipment will ensure on-time delivery and the ability to respond immediately to each customer's needs.



The Stafford Springs, CT facility is a newly constructed climate-controlled clean room, which contains the latest state-of-the-art branding, treatment, and packaging equipment in the industry. The Connecticut facility has an internal quality control laboratory and an extensive QC program. Although, CorkTec's stopper inventory is tested by an independent laboratory in Portugal, CorkTec performs a series of additional tests to ensure the customer receives the best quality stoppers.

CorkTec's mission is to supply the growing market of small, medium, and large wineries and vineyards by processing small to large orders with minimal lead times.

For more information, contact:

CorkTec

17 Middle River Dr.
Stafford Springs, CT 06076
tel: 860/851-9417; fax 860/749-3478
e-mail: sales@CorkTec.com
website: www.CorkTec.com

PLEASE SEE CORKTEC AD, PAGE 67.

GLOBAL PACKAGE LLC

Global Package LLC is introducing a new line of high-end, lighter-weight bottles — "Elegant Light" — in summer 2009. Addressing market demand for lighter weight, environmentally friendly bottles that are also ultra-premium in shape and color, Elegant Light features Bordeaux and Burgundy styles in weights reduced by 12% to 15%.

"While the bottles retain the larger neck, curvier body, and elegant punt lines that can position a wine at the top end of its category, their lighter weight provides significant cost savings in shipping and handling," according to Erica Harrop, founder of Global Package. "Wineries need not sacrifice image for cost savings. Elegant Light bottles match the look of heavier 'fancy glass' packaging without the environmental negatives. Even the most discerning brands will benefit."



global
package

The first Elegant Light bottles to be introduced — Bordeaux Max, Bordeaux SH, and Burgundy Bella — meet production requirements for capsule application, body width for large labels, and ease of changeover.

Global Package LLC also offers an extensive local (Northern California) inventory of stock bottles, customized bottles, and metallic label and design services from internationally acclaimed Tucker Creative.

For more information, contact:

Global Package LLC

Erica Harrop
PO Box 634, Napa, CA 94559
tel: 707/294-7899; fax: 707/224-5683
e-mail: info@globalpackage.net
website: www.globalpackage.net

PLEASE SEE GLOBAL PACKAGE AD, PAGE 73.

CIVISION

For more than 25 years, CIVision has designed and installed state-of-the-art turnkey vision inspection systems for a wide variety of wine and spirits applications, from inspecting empty glass bottles to full cases.



CIVision
Leader in Industrial Vision

Typical bottling inspections include:

- Chipped neck, cracked glass inspections;
- Pre- and post-washout debris inspections;
- Fill level, cork/capsule or cap inspections;
- Front, rear, neck, wrap-around label inspections;
- Code inspections including OCR, OCV, and bar-code;
- Unoriented label inspection;
- Empty/Full case inspections, inside and out.

CIVision inspection systems include all engineering, hardware, software, installation, start-up, documentation, and training.

CIVision's unique vision among providers of inspection systems is to develop the specific inspection system that meets each customer's individual needs. Any standard CIVision system can be modified to provide the exact speed, accuracy and number of inspections a customer requires. For truly unique applications, CIVision can develop custom systems tailored even more closely to a customer's needs.

For more information, contact:

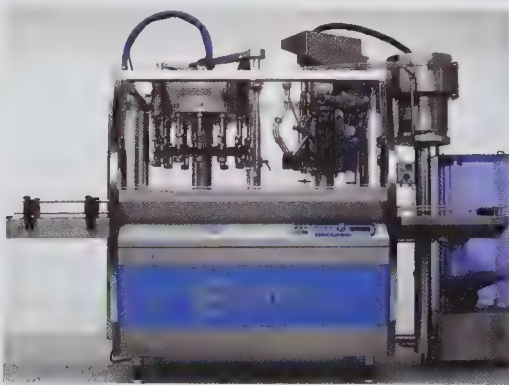
CIVision

2640 White Oak Circle, Unit A
Aurora, IL 60502
tel: 630/446-7700; fax: 630/446-7710
e-mail: info@civision.com
website: www.civision.com

PLEASE SEE CIVISION AD, PAGE 8.

KLR MACHINES, INC.

KLR Machines adds to its selection of high-quality equipment for the wine industry with the introduction of Costral Bottling Technology. A subsidiary of Bucher Vaslin, KLR Machines is aware and able to respond to the needs of the wine industry with new technologies and innovation. KLR's exclusive distributor agreement with Costral Bottling Technology for North America allows KLR to accommodate small, medium, and large wineries.



Costral's advanced bottling technology includes monobloc units, fully synchronized and digitally encoded. Costral's patented filler system ensures sanitary conditions, easy cleaning, and long-wearing component parts.

Costral's multi-head corker units accommodate traditional cork and a variety of synthetic closures and screw caps with technology to easily change from one closure to another. Labelers and rinsers are also available.

As with KLR's Bucher Vaslin equipment, KLR ensures a spare parts stock of commonly used parts. With Costral Bottling Technology, KLR continues to provide locally accessible full service on all equipment represented, throughout North America.

To learn more about Costral Bottling Technology products and to receive an expert consultation and quote, please contact KLR Machines offices or visit the website to find a local sales representative.

For more information, contact:

KLR Machines, Inc.

350 Morris St., Ste. E, Sebastopol, CA 94572

tel: 707/823-2883; fax: 707/823-6954

website: www.klrmachines.com

PLEASE SEE KLR MACHINES AD, PAGE 33.

CAMERON FAMILY GLASS PACKAGING

Cameron Family Glass Packaging (CFGP) is a new producer in the glass market with a new way of doing business. A family-owned manufacturer with state-of-the-art equipment, CFGP is dedicated to producing the highest quality glass wine bottles, building relationships that maximize customer service and satisfaction, and being a socially-responsible steward to the environment.

- **Factory Direct Sales:** CFGP will sell directly to wineries, avoiding distributors who add marginal cost when reselling to wineries;

- **Focus on Customer Service:** CFGP will have a professional Account Managers who are accessible, responsive, and committed to superior customer service;

- **Eco-Friendly Manufacturing:** CFGP utilizes environmentally-friendly hydro-power to run its 250-ton electric melter — buying CFGP bottles will have a positive impact in reducing your carbon footprint;



- **Made in the USA:** CFGP recently completed building the first glass plant in the U.S. in more than 30 years.

Cameron Family Glass is the domestic alternative for high-quality stock, premium, and ultra-premium wine bottles.

For more information, contact:

Cameron Family Glass Packaging

Hans Dippel: 707/889-7111

Ken Seymour: 707/889-7077

2310 N. Hendrickson Dr., Kalama, WA 98625

tel: 877/226-3659 (877-CAM-FMLY)

website: www.cameronfamilyglass.com

ZORK USA

Package your point of difference. ZORK is the wine closure that delivers innovation, design, and functionality that solves the problems of cork taint and random oxidation.

ZORK® features:

- Consistent and predictable oxygen transmission rate (OTR);
- ZORK will not leak, taint, or contaminate wine;
- ZORK is easy to apply and works with a variety of filling/capping equipment;
- In independent consumer acceptance research conducted by a major U.S. wine company, a majority of respondents ranked ZORK in the top three in preference of available wine closures, ahead of cork and screw caps.



For more information, contact:

ZORK USA

951 Douglas Rd., Batavia, IL 60510

toll-free: 866/996-9675; fax: 630/406-8442

e-mail: info@zorkusa.com

website: www.zorkusa.com

PLEASE SEE ZORK USA AD, PAGE 43.

CRYOTECH INTERNATIONAL, INC.

Cryotech International, a leader in liquid nitrogen delivery systems for container pressurization and/or oxygen displacement, can help wineries reduce headspace oxygen and extend shelf-life in screw cap packages while maintaining taste.

More and more winemakers are making the switch to screw caps to preserve the fresh fruit taste of their wines and to reduce bottling cost. With this change comes concern over the additional headspace that would normally be displaced by a cork. The headspace can become a holding area for excess oxygen and cause oxidation of the wine.



CRYOTECH
VBS INTERNATIONAL

Many winemakers have discovered that adding liquid nitrogen dosing to their bottling operation is a cost-effective way to eliminate excess oxygen and maintain wine taste and quality.

Cryotech has a complete line of liquid nitrogen dosing equipment to automate and control the introduction of LN₂. A very small dose of LN₂ is injected into the filled bottle. One part of liquid nitrogen warms and turns into 700 parts of gas, displacing O₂ from the headspace.

After installing a Cryotech injection system, one customer reported dissolved oxygen content of less than 0.03 ppm without compromising the fresh fruit taste of the wine.

For more information, contact:

Cryotech International, Inc.

745-B Camden Ave., Campbell, CA 95008

tel: 408/371-3303; fax: 408/371-3320

e-mail: salesinquiry@cryotechinternational.com

website: www.cryotechinternational.com

Heat Stress

Continued from page 62

into higher production costs. Heat stress is probably under-credited as a factor contributing to workplace accidents.

How do these symptoms develop?

When metabolism generates heat faster than needed, adjustments begin in the circulatory system. The heart pumps faster and blood vessels dilate (expand) to bring more blood to surface layers of skin, from which the heat it carries is conducted, convected, and radiated to the cooler environment. This shift in flow slows the delivery of nutrients and oxygen to muscles, brain, and other organs, reducing strength, alertness, and stamina.

If a body cannot cool fast enough this way alone, or when the air is warmer than the skin, it resorts to sweating, which dissipates heat more quickly but at further cost to circulation.

Sweat glands draw water from the bloodstream. The longer that sweating goes on, the less blood volume remains to serve cooling and other body functions, and the greater the risk of experiencing symptoms of heat illness. A 150-lb. person performing moderately active work in warm weather, for example, would lose about ¾ quart of water, or 1% of body weight, per hour. At that rate, without replacing any of the lost fluid, one would feel a notable loss of energy and endurance after three hours, have serious fatigue and nausea after six hours, and lose consciousness after eight hours.

Keys to prevention

Research in sports, exercise, military, and industrial settings has yielded applicable lessons about heat stress. Not surprisingly, the preventive measure that these studies most strongly recommend is to steadily replenish the fluid that the body loses as sweat.

Because thirst signals a water deficit only after it begins to affect performance, starting to drink before or early in a work day is safer than waiting to feel the need. Small amounts frequently are better than a large amount at once. The amount of water needed to replace loss through sweating is a function of work-strenuousness and pace, weather, and personal physical attributes.

At most vineyards, water in an Igloo® or similar container is available to employees throughout the day.

Observations from two field studies and talks with numerous managers, however, are that production workers tend to visit the Igloo® infrequently, when quite thirsty and that they drink large quantities on each visit. This pattern results in a low volume and poor rate of fluid replenishment during the day.

When workers do not drink as much or often as they need, it is typically because they perceive high "costs" to obtain the water that is provided relative to its value to them. Impediments to Igloo® access can include physical effort, supervisory or co-worker disdain, foregone earnings opportunity when on piece-rate pay, and fear of ingesting microbes from the water or container. For both workers and managers, putting too low a priority on fluid replacement may stem from limited knowledge of how the body generates and copes with internal heat.

Without understanding the reasons behind advice to drink water frequently, workers are not as equipped or motivated as they should be for their part in combating heat stress, and supervisors are less apt to assist them with logistical support, information, and personal example.

California regulation basics

California became the first state in the U.S. with a workplace safety rule on occupational heat illness in 2005. An emergency standard adopted in 2005 was replaced by a permanent regulation in 2006. Cal/OSHA published its interpretation and enforcement guidelines on several points in March 2009.

The Heat Illness Prevention (HIP) Standard (CA Code of Regulations, Title 8, Chapter 4, Subchapter 7, Group 2, Article 10) now applies to all outdoor workplaces in California, all the time. In brief, it requires employers of people who work outside to provide four things:

1. One quart of drinking water per person-hour for the entire work shift;
2. A shaded rest area and the opportunity to use it five minutes or more;
3. Training on nine specific topics for all employees, and on an additional two for supervisors; and

4. Written documentation of procedures to be followed in complying with the regulation.

Definitions in the regulation text and interpretations in a Q&A document from Cal/OSHA elaborate on these requirements and instruct enforcement personnel. Regarding water, unless a plumbed or other continuous supply is readily available to workers, the whole amount is to be provided in portable containers either at the beginning of the shift or in stages through a reliable system of replenishment that allows all employees to drink at least one quart per hour.

Employers are considered out of compliance if at any time no drinking water is available, or if the replenishment practice is to wait until either the container is empty or employees request more water. Cal/OSHA sees a replenishment system as unreliable if employees feel pressured to reduce their water consumption in order to conserve for later in the day.

Shade, according to the regulation, is blockage of direct sunlight. It can be provided by buildings, canopies, awnings, "popup" or other temporary structures, and even trees. A shaded area that is too hot to allow the body to cool is not acceptable. Access to shade is to be permitted at all times to any employee "suffering from heat illness or believing a preventive recovery period is needed" (even prior to any symptoms).

Cal/OSHA has adopted temperature-triggers in 2009 for portable shade structures to be in place before any worker requests. Inspectors expect to find shade existing and available at the start of a shift if the National Weather Service forecasts a daily high above 85° F or immediately if the temperature reaches 90° F.

While it does not specify training methods, Cal/OSHA says that evaluation of compliance will also depend on manner of presentation, and that enforcement personnel will quiz employees in assessing whether an employer has made a good faith effort to convey essential content.

Topics required in training for all employees are:

- Environmental and personal risk factors for heat illness;
- Importance of frequent water consumption, especially when weather is hot and sweating is more than usual;

- Importance of acclimatization;
- Common signs and symptoms of different heat illnesses;
- Importance of immediately reporting to employer, directly or through a supervisor, signs of heat illness in self or co-workers;
- Employer's procedures for responding to symptoms;
- Employer's procedures for contacting and transporting to emergency medical care;
- Employer's procedures for clearly directing emergency responders to the worksite;
- Employer's other procedures for complying with this standard.

Supervisors also must know:

- Procedures to follow in implementing the heat illness prevention plan;
- Procedures to follow in responding to employee symptoms of possible heat illness.

Documentation of compliance and response procedures is to be made available to employees and enforcement personnel upon request. It may be kept as a stand-alone policy but probably is best integrated into the employer's overall injury and illness prevention program.

Cal/OSHA has stepped up its efforts to inform employers about and enforce heat illness prevention rules. From January through May (2009), Cal/OSHA staff spoke to 4,000 agricultural employers at seminars across the state, conducted 850 heat-related inspections (in all industries), and issued more than 250 citations for breaches of the heat illness prevention standard. In 2008, it recorded 2,584 inspections and 1,134 citations, more than half of them for lack of a written compliance plan. Cal/OSHA offers more information about the regulation and how to comply at www.dir.ca.gov/heatillness.

Meeting challenges on the ground

Controlling heat stress is a team sport. To minimize chances of harm from excess heat, managers, first-line supervisors, and workers themselves have to take actions based on more than the state's blanket rules. Various managerial decisions affect workers' inclination to drink and rest as needed. Operators can adjust procedures and equipment to improve access to water, shade, and knowledge about heat stress physiology.

Growers and contractors are telling foremen to keep Igloos closer to work activity, provide assorted pop-up canopies, umbrellas, and camp awnings for portable shade and supply plastic chairs for rest. Some have fashioned mobile shade and water stations from simple trailers.

Knowledge of a few physiological principles is needed up and down the line to inform choices that protect against harm from heat while fitting with other business objectives. Since vineyard and winery workers are just as inclined as anyone else to make reasonable decisions based on what they know, managers can effectively support workers' day-to-day risk control by helping them understand the causes, consequences, and autonomic responses to heat stress.

A list of ten key points to convey during worker education is available at http://cefresno.ucdavis.edu/newsletterfiles/Vine_Lines14818.pdf newsletter, August 2008, page 10. They can be presented in orientations, tailgate meetings, and company handbooks. A two-sided, bilingual folding heat stress information card and other references and field training tools are available from grower organizations, Cal/OSHA, and UC-DANR.

No matter how Cal/OSHA administers the new regulation, there is no substitute for exercising informed personal judgments at managerial, supervisory, and production crew levels of a vineyard operation. Managers do well for their businesses and their crews when they consider environmental conditions and physical job demands in scheduling work, make access to water as easy as possible, and patiently explain why frequent visits to water are a good idea.

The array of references and instructional aids for workplace education about heat stress physiology has expanded in recent years. Much can be gained by drawing from it to give workers and supervisors substantial knowledge rather than a mechanical recitation of cautions, commands, and mantras.

Everybody in a grape production business is better off when all join in understanding and battling heat stress. ■

Howard Rosenberg is a UC Cooperative Extension Specialist based at UC Berkeley and focuses on farm personnel management issues.

IN MEMORIAM

McDonald D. Blackburn

January 22, 1954 – April 23, 2009

Winemaker, philosopher, ballet dancer, social critic, craftsman, frontiersman, resource conservationist, skydiver, musicologist, writer, surfer, Scottish Presbyterian, *PWV* contributor, and devoted husband and father — Don Blackburn died after a battle with cancer at 54 years of age.

A man of insatiable curiosity, eccentric, noble, and endearing with an impish sense of fun, Don lived his life with boundless passion. As a Norwegian-born, French-trained American winemaker, he leaves a legacy as one of the finest creators of Pinot Noir in the world.

As an avid social critic, Don cared deeply about cultural responsibility and education and enjoyed speaking about these things. Perhaps the person who listened most carefully was his son, Devon, who remembers “a loving, caring father who did everything he could to teach me the right lessons in life.”

Don, in turn, had learned the discipline of his life from his own father, a Brigadier General who helped establish the Army’s elite Special Operations Forces, yet according to Don, “his whole life was dedicated to saving lives.”

Don’s first exposure to wine occurred during a senior year language exchange program placed in a grape harvest in Burgundy. After the harvest, he redirected his path from human ecology to winegrowing. He spent six years in France, where he earned a BTS, Brevet de technicien supérieur, with honors in viticulture and enology from the School of Viticulture in Beaune.

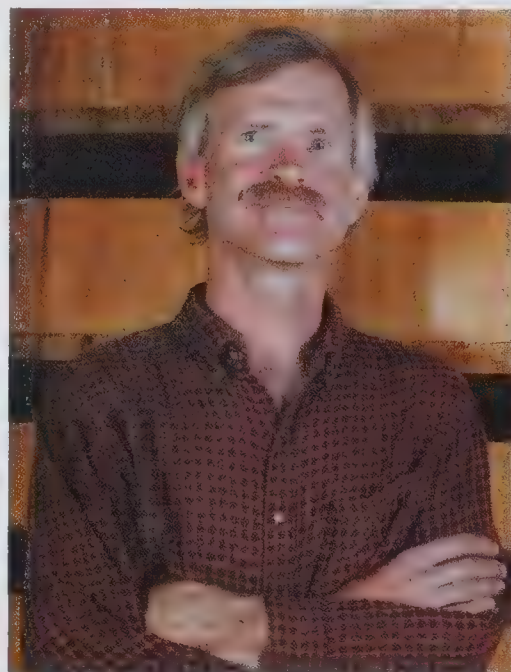
He continued his education in the vineyards and cellars of Burgundy at Domaine des Comtes Lafon (Meursault), Domaine Mongeard-Mugneret (Vosne Romanée), and Château de Monthélie. He became a Burgundian specialist, though he broadened his knowledge with intern-

ships in other wine regions: Bordeaux (Chateau Cheval Blanc and Chateau Giscours), and Alsace (Maison Trimbach).

He studied texts dating back to the 17th century to uncover the roots of the practical aspects of winemaking, learning techniques that we are now rediscovering with the help of technology.

His 25-year winemaking career in the U.S. includes winemaking positions at Elliston Vineyards (Sunol, CA), Bernardus Vineyards (Carmel Valley, CA), Byington Winery (Los Gatos, CA), and David Bruce Winery (Los Gatos, CA).

His career culminated with the crafting of his finest Pinot Noirs at Emeritus Vineyards (Sebastopol, CA) in the Russian River Valley, where his favorite vineyard has been renamed in his honor as McDonald Mountain.



“He was a tremendously positive influence,” says Brice Jones, founder and president of Emeritus Vineyards. Blackburn was head of winemaking at Emeritus beginning with the winery’s inaugural 2004 vintage.

“McDonald Mountain is a new 30-acre vineyard, just completed planting in Spring 2009,” explains Jones. “We told Don three days before he expired, that we were naming it for him as McDonald Mountain — in honor of the fact that Don was a mountain of a man. The name will, in due course, appear on a bottle of exquisite Pinot Noir pro-

duced from grapes grown on that parcel.”

One of Don’s many protégés described him as the Plato of winemaking, although in actuality he preferred Aristotle. Don believed the finest quality a wine could aspire to was charm, not concentration, and while appreciating technology, in the final analysis he relied upon his intuition.

Don’s approach to Pinot Noir is best stated in his own words:

“Our goal at Emeritus Vineyards is to make wine whose main characteristic — the one transcending grape variety and vineyard character — is charm. That quality, for Pinot Noir, is the hallmark of excellence. Pinot Noir is best described in terms that are holistic rather than analytical. Single descriptive adjectives fail to capture the visceral appeal of Pinot Noir.

“Charm is a seduction that occurs on a subliminal level. The initial dimension of charm is an attribute of mouthfeel. Tactile charm requires perfection in the sense that nothing is lacking. Textural charm is supple yet with vibrant tannins. Charm is also an aromatic quality that is clean and airy, with aromas that work harmoniously toward creating a complete, well-focused impression that gives the taster an ineffable sense of well-being.”

Don never made wine “by the numbers.” Instead he used intuitive metaphors, often from music and poetry, when describing his wines.

PWV journal was privileged to publish 17 contributions by Don Blackburn between 1985 and 2005. Don began his 20 years of writing at *PWV journal* with a 10-part series on Burgundian Viticulture to share his experience and knowledge gained working in Burgundy, France. Don also contributed reports on:

- Yeast Hulls (1985);
- Sulfur Dioxide (1988);
- Tartrate Stability (2004);
- Micro-Oxygenation (2004);
- and two reports on Winegrowing of Pinot Noir in Russian River Valley (2005).



Making ICON wine: Guidelines for vineyard management

Many wineries are focused on producing an icon wine, in the belief that it will help market other wines in their portfolio. I suppose there is a great degree of self satisfaction for all of the people involved.

In the last few years, I have had clients in several countries who were on this path, and I was always interested in how they went about it. Sometimes the approaches were (in my opinion) seemingly naive, like: "We just thinned really hard, and then hand-picked," or equally as trite: "I went into the vineyard every morning for three weeks, and tasted the fruit and looked at seed color to choose when to harvest. This made all the difference!"

One has to ask, is this all there is between icon wines and premium wines — a few simple vineyard manipulations? And they are performed very late in the growing cycle, often near harvest?

I found it difficult to find anyone on the winemaking team, including the viticulturist, who when pressed harder could give what I felt were sound guidelines for the selection and management of vineyards to make icon wines.

Wineries or Vineyards?

I want to recap and look at this notion from a very general perspective. We can, I think, create icon wines by using any of three processes.

First, one may use new techniques in the cellar that will have an unusual but significant sensory impact. An example from several decades ago is the use of new wood barrels for red wines, and, some years later, for white wines. Now most cellars around the world have adequate access to new wood, so that this treatment is no longer an icon differential. Nor do I think icon wines can be made by any special yeast strain or fermentation process. So, from my perhaps limited enology, and I suppose viticultural bias, icon wines will not be "created in the winery."

Second, some wineries harvest many small parcels of grapes, and the icon wine may be made from a selection of their best lots. Although this is a valid process, it is expensive and guarantees neither outcome nor reliability of results from year to year.

Third is the option of choosing an "icon wine vineyard," made from one or more blocks or parts thereof. These parcels may (or may not) be managed differently to produce an icon wine, as noted in the examples of thinning, hand-picking, tasting, and watching seed color mentioned above, not that these were approaches that I would necessarily endorse.

I have been critical of other people's approach to the selection and management of "icon" vineyard parcels. I welcome reader feedback.

Smart approach to selection and management of icon vineyards

When I think of growing fruit suitable for an icon wine, I think of an analogy involving a suspended chain holding a weight. Each link in the chain is of different thickness (strength), and represents a different vineyard attribute or management process. The weight at the bottom represents wine quality outcome, and will be heaviest for an icon wine.

The point of this analogy is that if any one link fails, then the whole chain is rendered useless, and the wine quality goal will not be met. Those attributes or processes that are most important can be represented by weaker links in the chain. In other words, it is more important to get these right than some other management options or attributes that can be represented by stronger links.

These are the factors I think are important in growing icon wine, arranged more or less in order of priority — that is the weaker links, which deserve the most attention, are toward the top.

1. Right climate-variety-clone combination — I see little sense in trying to make an icon wine from a grape variety that has no possibility of being specially distinctive. In other words, if the variety you have chosen does not already have a reputation for ultra-premium wine quality in your region, then the possibility of creating a true icon wine is very remote. I mention clone also, because, for some varieties like Pinot Noir, the clone chosen can have a significant outcome on wine quality.

2. Vineyard uniformity — There is little prospect of making an icon wine out of a vineyard that is very large and/or not very uniform. Such a vineyard is variable in vigor, physiological status, and canopy microclimate, and will fail to meet many of the criteria below.



A candidate vineyard for icon wine? Note excellent leaf and fruit exposure on Scott Henry trained Pinot Noir clone 114 in Tasmania, and general good leaf health (with a little senescence).

3. Vine balance — Proper vine balance is essential for producing premium fruit suitable for icon wines. By vine balance, I mean the ratio of fruit to functional leaf area; the latter is in turn related to vegetative growth. Vine balance depends on pruning decisions, which must be related to vine vigor, and may also be related to subsequent shoot and cluster thinning. I think vine balance is more important than yield per se.

4. Canopy microclimate — While microclimate requirements may vary from variety to variety and from year to year, in general there is a need for sufficient leaf and fruit exposure, and avoidance of shade. Well-known but infrequently adopted trellis techniques are available to achieve such an outcome.

5. Vine physiological status — There are many aspects of this and most are regulated by irrigation and canopy management decisions, although nutrition is not to be ignored. Our recent research in Tasmania is, for example, indicating the importance of late season leaf health for Pinot Noir, which can be impacted by water and nitrogen stress inducing senescence.

6. Shoot tip growth — Regulation of shoot tip growth is especially important for red wine quality, and also for many white varieties. A good rule of thumb is that active shoot

growth should stop about two weeks before veraison, and be associated with early and rapid onset of veraison and cane lignification.

7. Disease, pests, and stress status — For most commercial vineyards, this is not an issue. However, heat stress has been an important consideration for many regions in Australia in the 2009 vintage. Failure to adequately control pests or disease and to avoid significant stress can be a cause of diminished fruit quality.

8. Timely harvest decision — This is not an issue that it is found wanting in most commercial vineyards. For many varieties, I am skeptical about the claims by enologists that they can determine the optimal time for harvest by tasting grapes.

9. Excessive yield — In many commercial vineyards, yield levels are neither inappropriate nor excessive. Yet the first command that comes from the winery is generally one of yield reduction. In my opinion, in the pursuit of icon wine, the other factors listed above generally are more important, and they all can be quantified.

10. Harvest method — In many situations, harvest method is quite unimportant. What seems of more importance is the temperature of the fruit and the time taken before processing. I have clients in California who hand-harvest at night in a very economical fashion, and this process could be adopted more widely.

Conclusion

I could have written one page on each of the factors listed above. Generally these ideas are not new, but one does not often see them ranked as I have. I would emphasize that most of these entries can be readily quantified, and so it would be easy to develop a protocol of measurement systems as a form of quality assurance of events. Anyone interested in making icon wine the "smart way?" ■

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SANITARY DESIGN

A critical, underestimated component of winery sanitation

Planning for sanitary design when building new facilities, upgrading current facilities, installing new equipment, upgrading equipment, repairing equipment, maintaining infrastructure and equipment, and operating equipment is as important as a winery-wide sanitation program in preventing microbial contamination of wine.¹ The combination of good sanitary design and an effective sanitation program:

- 1) prevents microbial contamination and pest ingress thus reducing risk to product quality;
- 2) reduces cleaning and sanitizing time;
- 3) reduces costs for chemicals, maintenance, and repair;
- 4) reduces energy and water usage; and
- 5) improves productivity due to reduced rework and increased employee morale.

The impact on employee morale and thus productivity of an aesthetically pleasing work environment, good design of equipment and infrastructure to facilitate efficient sanitary practices, the availability of equipment, and the ability to produce a high quality wine cannot be overestimated.

Unfortunately, when final decisions need to be made about upgrading, constructing, or purchasing new facilities or upgrading and/or purchasing equipment, sanitary design is almost always the first quality improvement to be sacrificed to save money. Being short-sighted at this stage will usually cost a winery more money in the long run, due to expensive retro-fitting to correct poor sanitary design, increased sanitation costs (labor, chemicals, energy, water, etc.), reduced productivity, and/or reduced wine quality.

In this column, we will review the 10 primary principles of sanitary design, consider the importance of each with respect to winery sanitation, and offer recommendations to achieve good sanitary design.

Cleanable to a microbiological level

Winery equipment and infrastructure should be constructed, so they can be effectively and efficiently cleaned over the course of their lifespan. Equipment design should prevent microbial ingress, survival, and growth on both product and non-product contact surfaces. This includes making sure all surfaces are accessible for mechanical cleaning to prevent bio-film formation.

Made of compatible materials

Materials used to upgrade or construct equipment should be completely compatible with product present in the winery (must, juice, wine, etc.), cleaning and sanitizing chemicals, and the methods used for cleaning and sanitation. Specifically, keep the following items in mind when constructing new equipment or upgrading equipment:

1. Product contact surfaces must be made with materials which are corrosion-resistant, non-toxic, and non-absorbent.
2. 304-grade stainless steel is recommended for non-product contact surfaces and infrastructure, and 316-grade stainless steel is recommended for product contact surfaces.
3. Plated, painted, or coated surfaces or corrosive materials should not be used for product contact surfaces or for surfaces above product zone areas.
4. Materials that should not be used include wood, enamelware, uncoated aluminum, uncoated anodized aluminum, etc.
5. Metals should be compatible with one another.
6. The following materials should not be used in product contact areas: copper, brass, bronze, zinc, lead, cadmium, antimony, or plastics containing phenol, formaldehyde, or plasticizers.

Accessible for inspection, maintenance, cleaning, and sanitation

Equipment and infrastructure should be readily accessible for inspection, maintenance, cleaning, and sanitation. Recommendations for sufficient accessibility include:

1. Equipment must be easily accessed without the use of tools.
2. Machinery and chain guards must drain away from product zones and be easily removed.
3. Product catch pans or drip pans must be easily removable for clean-up, so they are not lost or separated from the equipment.

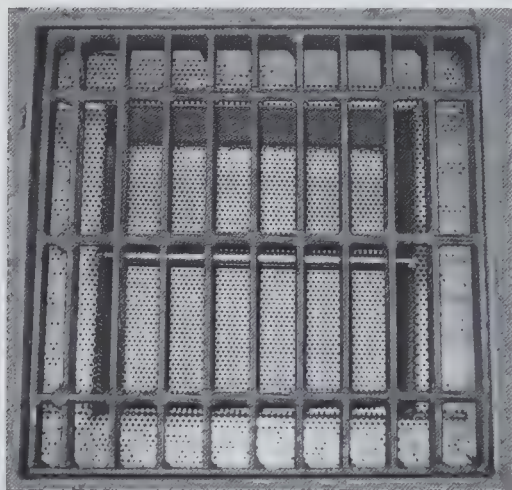


Figure I. Floor drain with cover to prevent pests from entering.

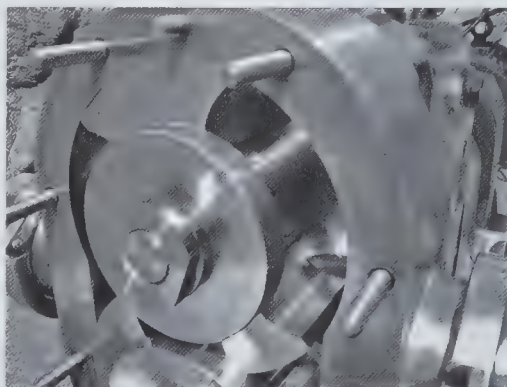


Figure II. Waukesha pump interior pumping mechanism that is free of niches such as cracks, pits, gaps, and corrosion. Photos taken at Flora Springs Winery, St. Helena, CA.

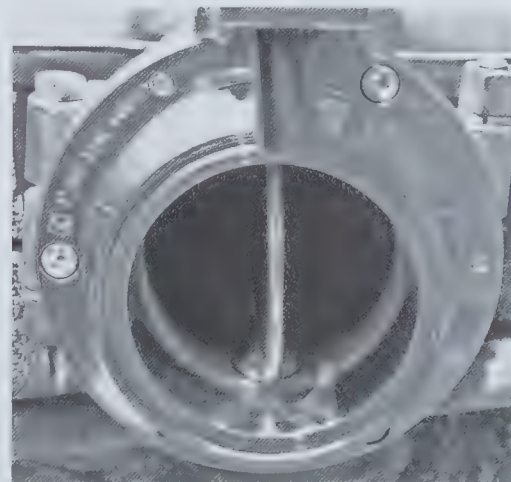


Figure III. Butterfly valve that is free of niches such as cracks, pits, gaps, corrosion, and open seams.

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4. Equipment should be located 30 inches from overhead structures.
5. Equipment must be a minimum of 12 inches off the floor to permit adequate cleaning and sanitation.
6. All air, vacuum, and product hoses, and their assemblies attached to the equipment must be easily removable for soaking and sanitizing.
7. All air, vacuum, product hoses must be transparent or opaque, and meet product contact surface guidelines.
8. Infrastructure containing production operations must be designed/constructed to act as a barrier for insects, rodents, moisture, and dust.
9. Lighting in processing areas must be sufficient to allow effective inspection of cleaning and sanitation practices.

No product or liquid collection

To ensure that liquids do not accumulate, pool, or condense, thus permitting growth of microbes, equipment and infrastructure should be self-draining. To avoid liquid collection, follow these guidelines:

1. All open surface areas must be strong enough to prevent warpage and subsequent pooling of water.
2. Moisture cannot be allowed to drip or drain into product areas.
3. Build a curb around wet processing areas to confine and conduct excess liquids to area drains.
4. To prevent accumulation of residual pockets of liquids, all piping should be completely free draining.
5. Do not use piping that is completely flat or has sharp angles; instead use piping that is slanted and has rounded turns.
6. Floors should drain freely to drainage system; there should no areas of pooling or standing liquids.
7. Do not use absorbent materials on equipment or infrastructure.
8. Air handling systems must be self-draining.

Hollow areas hermetically sealed

Any hollow areas in equipment or infrastructure must be eliminated or permanently sealed to prevent accumulation of pests and microorganisms. Avoid or eliminate hollow areas by following these guidelines:

1. Conveyor rollers should not be hollow to prevent liquids getting inside and then leaking out.
2. All floor drains must have a cover to prevent pests from entering. (See Figure I.)
3. All doors and windows must be properly sealed to prevent pest ingress.
4. Screens must be mounted on all windows that can be opened to the outside.
5. Gaps present around piping entering buildings must be sealed.

No niches

All equipment (pumps and valves) should be free of niches, such as cracks, pits, gaps, corrosion, open seams, bolt rivets, and dead legs, to eliminate the possibility of microbe accumulation and subsequent growth. (See Figures II and III.) Niches can be prevented and managed by following these recommendations:

1. All joints and welds should be flush and free of pits, cracks, and corrosion.
2. All welds must be continuous, smooth, and polished.

3. Caulking cannot be used on equipment in product processing areas due to its propensity to form cracks over time.
4. No tape, including Teflon tape, can be used in product processing areas.
5. Threaded fittings must not be used for product contact surfaces.
6. Use sanitary gauges to prevent microbe accumulation inside gauges.

Sanitary operational performance

During normal operations, equipment should not contribute to unsanitary conditions at the winery. Avoid unsanitary conditions as a result of equipment performance by following these recommendations:

1. Buttons on control panels should be easy to clean and sanitize during operations.
2. All compressed air used during processing should be filtered to a minimum of a 0.3 micron level and dried to prevent the formation of moisture in the piping system.
3. Product contact surfaces must be constructed to prevent build-up of product residue during operation.
4. Separate product contact and non-product contact areas to prevent cross contamination.
5. Direct air blowing equipment away from processing equipment.

Sanitary design of maintenance enclosures and interfaces

Maintenance enclosures (such as electrical control boxes) and human-machine interfaces (such as touch-screens or push buttons) must be designed to ensure that water or product does not get in or on enclosures and interfaces. The following guidelines can be used to ensure that water or product does not get in or on enclosures and interfaces:

1. Drives, chain guards, electrical control boxes, and bearings must not be located over open product zones.
2. Utility supply lines and pipes should be separated to prevent catch points and to allow for cleaning.
3. Utility lines should be 12 inches off of the floor and cleanable.
4. Conduit and supply lines should not be routed above product contact areas.
5. Maintenance enclosures in required cleaning and sanitation areas must be constructed so that they cannot be exposed to water or chemicals.
6. Maintenance enclosures must have sloped tops, so they do not accumulate soils, organic debris.

Sanitary compatibility of equipment with other systems

When designing new equipment or upgrading equipment, sanitary compatibility must be considered in relation to other equipment and systems, such as water, air, steam, and electrical. Some examples of sanitary compatibility are:

1. The water supply must have a backflow prevention device to prevent microbial contamination of water during production activities.
2. All process gases must be filtered through a 0.22 micron filter.
3. When connecting new or upgraded equipment to other systems, make sure metal connections are compatible to prevent electrolytic corrosion. Corroded connections can harbor microbes.

WINE MICROBIOLOGY

Validate cleaning and sanitizing protocols

Prior to installing new or upgraded equipment, work with equipment vendors to make sure the sanitary design is sufficient to allow equipment to be effectively cleaned and sanitized to prevent microbe accumulation and to prevent chemicals from corroding equipment. Wineries should use the following guidelines when installing or upgrading winery equipment:

1. Cleaners and sanitizers should be considered during the equipment design process.
2. Cleaning and sanitation practices must be validated for equipment before installing.
3. Equipment materials must be reviewed in conjunction with MSDS for cleaning and sanitizing chemicals to ensure compatibility.

Conclusion

An effective winery sanitation program should include:

- validated and effective cleaning and sanitation practices (such as sanitation standard operating procedures, a master cleaning and sanitation schedule, and microbial specifications for equipment and infrastructure);
- method(s) to monitor effectiveness of sanitation practices;
- ongoing monitoring of sanitation effectiveness;
- sanitary design and construction of equipment/infrastructure.

Proper sanitary design and construction of winery equipment and infrastructure are essential to maintain a clean and

sanitary operation. Sanitary design begins with a facility that effectively minimizes environmental contamination, such as pests and wine spoilage microbes.

Facility infrastructure (walls, floors, ceiling) must be made of smooth, impervious surfaces and must drain properly to discourage pest entry, prevent microbial accumulation, and allow effective cleaning and sanitation practices.

To minimize microbial populations and subsequent growth, all equipment should be of sanitary design and construction such that it is accessible for inspection, cleaning, and sanitation; has no niches, avoids liquid collection; is compatible with other plant systems; and contact surfaces are constructed of food grade materials that are corrosion-resistant and inert.

References

1. Tracy, R., and B. Skaalen. "Instituting a Winery Sanitation Program." *Practical Winery & Vineyard*. September/October 2008.

Dr. Robert Tracy, with nine years of scientific research experience and seven years of winery laboratory and quality control/quality assurance experience, specializes in wine chemistry and microbiology, winery sanitation, and QA/QC. He is co-founder of BevTrac Mobile Quality Systems LLC, based in Windsor, CA (www.bevtracquality.com), providing a mobile wine laboratory and consulting services to the wine industry. Please direct inquiries to robert.tracy@bevtracquality.com or tel: 707/239-8581.

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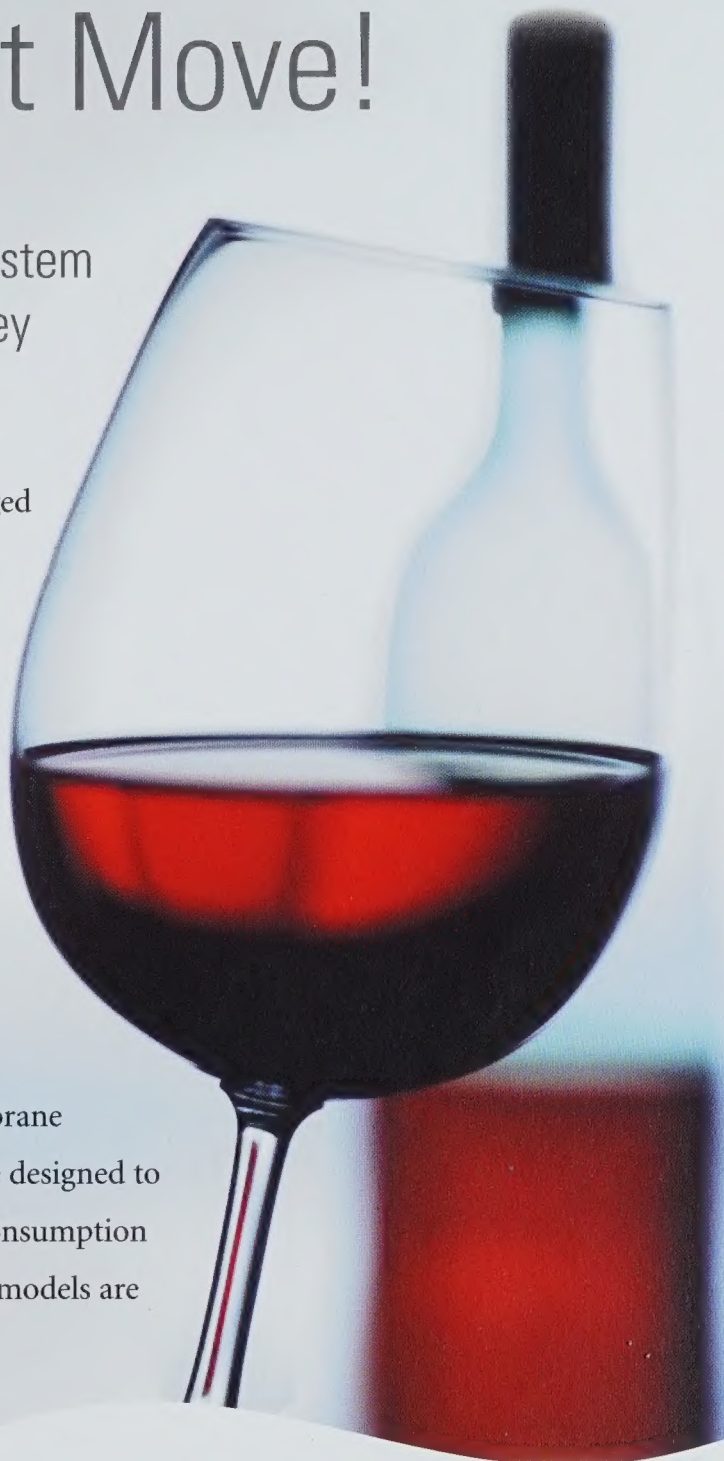
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Hill & Associates	42	707-258-2000		bestwinejobs.com	Winegrowing Consortium	19	888-897-3030		winegrowingconsortium.com
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JWB Marketing/ Bird Gard	25, 33	800-555-9634	803-796-0654	birddamage.com					
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KLR Machines	33	707-823-2883	707-823-6954	klrmachines.com					
Koch Membrane Systems	99	888-677-5624	978-694-7020	kochmembrane.com/wine5					
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